THE

# Malayan Agricultural Journal.

FEBRUARY. 1931.

## EDITORIAL.

**Voluntary Preference for Empire Products.** For the past five years the Imperial Economic Committee has studied the possibilities of improving the marketing of Empire produce within the United Kingdom. The Committee early came to the conclusion that for success in any policy of voluntary preference it was essential that the consumer be able to distinguish Empire goods from foreign goods and that he be educated to appreciate the economic advantages of buying within the Empire. Further, it was necessary for the Empire producer to realise that his products must at least equal those of his foreign competitor in quality, quantity and continuity of supply.

The Empire Marketing Board has been responsible for the publicity aimed at the education and guidance of public opinion in favour of voluntary preference.

As a result of this effort, the doctrine of voluntary preference has quickened and interest in the Empire become more defined. The Progress Report for 1930 of the Imperial Economic Committee briefly outlines the system upon which this endeavour has worked and gives the results to date, but it points out that a great deal remains to be done before the fundamental economic argument underlying voluntary preference becomes really the actuating motive of the great body of consumers.

There are few signs, the Committee states, that the wholesalers have changed their sources of supply to meet the growing consciousness on the part of the public. It is, however, fair to recognise that apart from pressure from the ultimate consumers, the trader *quâ* trader, has no strong economic motive for breaking away from his old connections. It is for the producer to contribute to this economic motive. Attention is repeatedly drawn by the Committee to the necessity in different trades for improvement by producers in the technique of their production and in the organisation of their selling.

The large sum of money which is now being spent in creating a new habit of mind among customers carries with it obligations on producers to produce foodstuffs of the right quantity, of the right quality, and of the right price. The reports of the Committee—seventeen in number—have dealt principally now with this and now with that element in a trade—in some cases, for instance, they have been addressed chiefly to the growers, in others to the distributors, in order to bring out the defects and to demonstrate the lines upon which real develop-

ments may be made in the production and marketing of goods within the Empire.

The Committee directs attention to three suggestions of a general nature that emerge from these enquiries. Firstly, Empire producers require information as to what is taking place in their several trades. Early intimation of some of this information, such as seasonal crop prospects, movements of crops, changes in marketing methods, tariffs, export and import regulations, is needed. Other information is of value to producers who contemplate the investment of capital in new developments and accordingly desire to obtain an idea of the future demand for the product they propose to cultivate. The formation of an Intelligence Service organised trade by trade is suggested to satisfy this need.

Secondly, the Committee expresses the opinion that the creation and assimilation of Empire Standards in regard to many trades, both of primary production and manufacture, should greatly simplify the promotion of Inter-Imperial trade.

In the third place, the Committee expresses its hope that under the lead of the Economic Organisation of the League of Nations, further steps may be taken to secure that trade statistics compiled by the various Governments of the World be based on such common rules as will render them more truly comparable.

The above brief references to the opinions of the Imperial Economic Committee are stated in this place because it is realised that Malaya is essentially a primary producer and a great many of the investigations of the Committee have therefore a direct bearing on the industries of this country. In this connection we would especially bring to the notice of producers in this country the following reports of the Imperial Economic Committee which may be obtained from H. M. Stationery Office, Kingsway, London, W.C.2. The prices quoted include postage.

The Policy of Voluntary Preference (The First Report, 10d.)

A Memorandum on the Trade of the British Empire 1913 and 1925 to 1928 (Thirteenth Report, 7d.)

Fruit (Third Report, 4s. 10d.)

Agricultural Machinery (Eleventh Report, 8d.)

Rubber Manufactured Goods (Fourteenth Report, 8d.)

**Malayan Pineapples at The Grocers' Exhibition.** The Publicity Officer of the Malayan Information Agency, in the course of his report on the Grocers' Exhibition, Portsmouth, 1930, stated that the event provided fresh proof that the Malayan Pineapple is making material progress in popularity now that the question of grading and packing have been seriously dealt with and it may reasonably be expected that an important new field has been opened up for the exploitation of the product. At this exhibition, opened tins of fourteen brands of the Malayan product were displayed to enable visitors to judge by their own senses of the quality of our product. As the "G.A.Q." (Good Average Quality) did not as a rule open well, these specimens were mainly confined to "Golden Quality." *Indeed, the show furnished yet another indication that the presence on the market of inferior "G.A.Q." stuff acts as a handicap to the progress of the ripe, well-graded and well-packed fruit, for the public are*

*liable to confuse one with the other.*

We have italicised the above words of the Publicity Officer because we would take this further opportunity of urging those concerned with the production and marketing of canned pineapples in Malaya to use every endeavour to maintain a high quality of packing. Improvements in this direction have been effected but they are not sufficiently widely adopted.

A great deal of most useful propaganda work in popularising Malayan Pineapples is being accomplished at exhibitions in the United Kingdom. For instance, at the above exhibition forty-five applications were received for the addresses of importers of Malayan Pineapples. If the present market is to be held and expansion effected it is of first importance that the quality of the pack shall be maintained at the highest possible standard commensurate with the price.

**The Coconut Census 1930.** The International Institute of Agriculture, Rome, planned a World Agricultural Census to be taken in 1930. It was in connection with the agricultural returns of Malaya for this Census that arrangements were put in hand to collect data concerning the area under coconuts.

While the results do not claim the accuracy that was desired, they undoubtedly express a closer approximation of the total area and of the distribution of the coconut areas than we possessed before. This data will be of considerable value in the persuit of copra investigations at present being carried out by the Department of Agriculture.

The coconut census has shewn that the small-holders' share of copra production is larger than was anticipated, a fact that adds point to the consideration at present being given to improvements in production and marketing of copra from such areas.

**Progress in Copra and Oil Palm Research** Two articles in this number: viz: "Experimental Work in Relation to Oil Palms" by Mr. B. Bunting and "The Economic Aspects of Copra Research" by Mr. F. C. Cooke are reviews of the progress of experimental work in this country which the authors presented at the recent Inter-Departmental Agricultural Conference at Kuala Lumpur. It is hoped that the reader will appreciate the practical aspects of the work in hand on these two crops. Both of these industries are of considerable value to Malaya. We hope that as a result of scientific research in close relation with estates, Malaya's pre-eminent position regarding the quality of palm oil exported may be maintained, and that in liaison with producers and exporters of copra, considerable improvements may be effected in connection with the quality our exports of copra.

# Original Articles.

## THE ECONOMIC FACTORS OF COPRA RESEARCH.*

BY

F. C. COOKE,

*Assistant Chemist for Copra Research.*

### Introduction.

The terms of reference of the copra research work that is being carried on in this country are as follows:—".....to determine what shall be the characteristics of a high-grade copra and by what methods of preparation suitable to large and small producers these characteristics can be secured."

This involves a careful stage-by-stage investigation of its preparation, storage and transport, commencing with the fruit and proceeding to the time when the copra arrives in Europe. The system of marketing, too, must be considered, as it has an extremely important bearing on the quality of the product leaving this country.

This report gives an account of the work done and of the enquiries made during the first of the four years allotted to this problem, while in the February issue of *The Malayan Agricultural Journal*, 1930, is to be found the programme originally outlined, and an account of the position up to 1929.

### Economic Aspects.

At present, three grades of copra are recognised in Malaya:—

F.M.S.—Fair merchantable sundried. (Best)

F.M.—Fair merchantable.

"Mixed"—Unsorted native copra.

These grades are by no means sharply defined nor is "F.M.S." copra, the highest grade, by any means a perfect product. "Mixed" copra is the bulked product collected by the provincial dealers from the small-holders in small parcels of one or two piculs. The quality of such "mixed" copra in different districts varies considerably, but is more or less equally good or bad within any one district. Owing to the poor price paid by the local dealer to the producer, the copra he buys is almost invariably wet and frequently very carelessly prepared. The blame for this state of affairs is not entirely on the side of the dealer who must protect himself against the deterioration of such an inferior product, nor is it entirely the fault of the small-holder who has no incentive whatever to take

* First part of a paper entitled "The Present-day Position Relating to Copra Research and Practical Issues Concerned Therewith," presented at the Second Inter-Departmental Agricultural Conference held at Kuala Lumpur in October 1930. Part II "Factors of Quality in Copra" and Part III "Types of Malayan Copra" will be published in subsequent numbers of this Journal.

extra trouble, but rather the reverse.

Accordingly, the "mixed" copra when it ultimately arrives at Penang or Singapore has to be redried and resorted to prepare it for the home markets. The copra is carefully picked over and the best pieces are removed, the inferior copra being classed as of "F.M." quality.

The separated "F.M.S." copra cannot be perfect copra because it has been in contact with the badly prepared product. This sets a standard for "F.M.S." copra, however, and practically perfect copra which may be obtained from a few estates generally at a slight premium may sometimes be untilised to improve and bring the quality of unsorted "mixed" copra up to Straits "F.M.S." standard. Most estates, furthermore, produce a copra needing no redrying or sorting and wholly "F.M.S." quality.

The important point to recognise is that the "F.M.S." standard is both an inferior and a flexible standard. Should increasing amounts of low grade copra become available, the standard for sorting may be relaxed to meet the home demands for "F.M.S." copra. On the other hand, if by some system of co-operative marketing among the small-holders they are encouraged to produce an improved "mixed" copra, then the shippers will be able to sort more carefully and so evolve a higher standard for "F.M.S." copra. The opinion has been expressed both in England and in Malaya that the general standard of "Malayan" copra has fallen during the last ten years with the result that a discriminating price has been paid for the copra from this country. To illustrate the general decline in quality, two examples may be quoted :—

| | |
|---|---|
| Imported (C) | Once 100 per cent. "F.M.S." now less than 50 per cent. "F.M.S." |
| East Coast, Malaya (A) | Once 50—70 per cent. "F.M.S." now 10—15 per cent. "F.M.S." |

It is also fairly generally alleged that Straits "F.M.S." copra is inferior in appearance and oil content to Ceylon "F.M.S." copra. Analyses in this department have shown that whereas the oil content of Malayan estates copra lies between 65 per cent. and 66 per cent. (dry basis)[1], the oil content of selected samples of Ceylon copra contain about 68 per cent. of oil (dry basis). Furthermore, it has been confirmed that Ceylon produces a very good, thick, white copra.[2]

The difference in the price obtained for Straits "F.M.S." and Ceylon "F.M.S." copra is considerable and amounts sometimes to nearly £2 per ton, the price paid for each being nearly proportional to the percentage oil content, with a bias in favour of Ceylon copra because of its whiteness.

The price paid for the Straits "F.M." product is, of course, still lower, so that the annual loss to the industry by careless methods of preparation or other causes may be roughly estimated to be over £100,000 per annum on a nett annual export of 110,000 tons; this estimate, however, is based on price considerations alone and omits the heavy hidden losses of actual copra, by deterioration in

1. Georgi. M.A.J. September, 1929 page 335.
2. Bunting. M.A.J. August, 1930 page 390.

transit between the producer and the manufacturer who only pays for the actual weight of residual copra he receives.

The situation is aggravated by the influence of the large amounts of inferior copra, some unmarketable for home consumption, which are received in Penang and Singapore from outside sources. In Ceylon, the copra comes from what may be regarded as one source and the industry is easily administered. On the other hand, Penang receives its copra from about three districts in Malaya and at least four districts outside, while Singapore draws on six districts in Malaya and some nine outside sources.

Unfortunately also, almost any kind of copra can obtain a market and there is actually a keen demand for bad copra, rich in oil (see later) which is cheap and available in large quantities. At present, any quality sells, and the dealers are quite satisfied to make a profit on a poor grade of copra, so that at present a poor grade of "F.M.S." copra controls the market.

With no fixed general standard of quality and because the local dealers do not pay any premium for well-dried and well-prepared copra, it is not surprising that the quality of "mixed" copra obtainable in any one district is of the lowest acceptable quality for that district and the continued tendency on the part of the producer will be to include just as much water in his product as he can without its being noticed.

The difficulty sometimes to be faced is that insufficiently dried copra may, when first produced, appear to be of the highest quality. Well-dried copra frequently has a slightly yellow tinge, whereas half-dried copra may still be snow white. Several rough tests for estimating the moisture content can, however, be applied:—

(1) if the copra is excessively wet it usually becomes hot and "sweating" when stored in bulk;

(2) if the copra is sufficiently dried the pieces break crisply when bent;

(3) the width of the dark line seen on the fresh fractured surface is also a criterion of the moisture content;

(4) A thin slice of copra is lit with a match—

  (a) if it burns readily, the moisture is less than 7 per cent.

  (b) if the flame splutters, the moisture is about 7—10 per cent.; at 10 per cent. it burns with difficulty;

  (c) if the moisture in the copra is above this, the slice will not burn at all.

It may be asked: What is wrong with a wet copra supposing it happens to be of good appearance? The trouble with such copra is that it will not retain its apparent high quality. Heavy mould growth, insect attack and self-heating all combine to reduce the amount, quality and value of the oil that can be derived from the copra and the colour, sweetness and value of the derived cattle cake. The exceedingly low price paid by the local dealer is actually a reflection of the risk he takes in buying such an unreliable product.

In the first place, the local dealer has to pay for the transport of the extra

water; he also is only paid for the dry weight of copra received at Singapore; he bears the brunt of any depreciation in transit due to the contained moisture; and finally, the price he is paid by the shipper is discounted on account of the cost of redrying and resorting at Penang or Singapore.

Thus, we have arrived at a deadlock in which the market is organised to expect an inferior product and pay for it at a very discriminating price. Whatever the small-holders may have to say about the price paid to them, nothing can be done for them until they combine and determine first to produce a better product, and then to study the market so as to obtain the best possible price for their product. Meanwhile, it does not pay a dealer to consider very small lots of well-prepared and well-dried copra.

In order to give a clear idea of the situation, the present system of buying and selling native copra must be briefly outlined. At the beginning of September, 1930, when the price paid for "mixed" copra at Singapore was about $6.50 per picul (133⅓ lbs.) the prevailing price in one district where is produced what may safely be described as the finest "mixed" native copra dealt with in Malaya was only $4.00. It must be admitted that even this copra was unnecessarily wet, since many of the producers were kiln drying for only 24 hours; while others adopted a kiln drying period of three days but obtained no added reward. The average small holding is about three acres and the nuts or, in a few cases, the copra produced are sold to a small local dealer with whom the producer frequently has a more or less permanent debt. This small dealer transports the copra by road to a bigger dealer who proceeds to ship the material by "tongkang" to Penang or Singapore where it is generally sold to yet another dealer who in turn bulks the material and sells to the big shipper.

The shipper dries the material for two or three weeks, weighs it and either pays for it at "mixed" prices or else sorts it into "F.M." and "F.M.S." grades, paying for each separately at the prevailing price. (If the "mixed" copra is wholly of bad "F.M." quality a special penalty is applied). While this represents a more or less extreme case of handling the material, the extreme difference in price between producer and shipper of $2.50 per picul is made up as follows:—

| | | |
|---|---|---|
| (1) | Old bags ... ... ... ... ... | 20 cents each. |
| (2) | Motor transport to the nearest port ... ... | 20 cents. |
| (2) | Export duty ... ... ... ... | 12 cents. |
| (4) | Shipping: nearest port to Singapore or Penang ... | 35 cents. |
| | | 87 cents. |

However, the high moisture content affects the issue very considerably and may be taken as equivalent to an added charge of 50 cents a picul so that the various middlemen share something between $1 and $1.50 per picul at existing

prices, though considerably more in better times.

The question that now arises is whether a good proportion of this profit cannot be transferred by better production and organised co-operative marketing into the pockets of the producers who, at present prices paid to them for their nuts and their copra, are experiencing very lean times. Particularly in view of the adverse world prices for edible oils, and the possibility of a continuance of low prices, every effort should be made to secure the best possible market and the best local bargain and to advance the quality so that Malayan copra may never fail to obtain a market.

# THE MALAYAN COCONUT CENSUS, 1930.

BY

D. H. GRIST,

*Agricultural Economist.*

No census of the coconut areas of Malaya has been attempted since 1924, when the results of such a census were published by the Economic Botanist in *The Malayan Agricultural Journal*, Vol. XIII, No. 6.*

In the 1930 Coconut Census, an attempt has been made to differentiate small holdings—which may be taken to supply local demand for fresh nuts—from the larger areas from which one may reasonably expect coconut products in commercial quantities. The former areas generally consist of coconuts interplanted with other crops—frequently rubber—and as a rule yield fewer nuts per palm than do those in the second category.

The actual census of areas under 100 acres each was, in most instances, taken by local headmen, who submitted lists of names of owners, particulars of their grants, and the area of coconuts if planted as a sole crop, or the number of coconut palms on each holding if in a mixed plantation. In each case returns were submitted of mature and immature areas separately.

The returns of areas on large estates were, as a rule, obtained as a result of written request to the managers or owners.

Returns were examined by the District Administrative Officers and/or by the Agricultural Field Officers. In a number of cases the latter officers instituted checks on the returns, before submitting them to the Division of Economics. In cases of doubt further checks of the returns were instituted by the Division.

The scheme worked fairly well for the Federated Malay States and Straits Settlements. It is probable that the returns are underestimated, possibly to the extent of from 5—10 per cent.

The position with respect to the Unfederated Malay States—especially Johore, Kelantan and Trengganu was unsatisfactory and the figures from these States are little more than estimates. Incomplete settlement and survey work and the lack of responsible headmen are among the causes of this unsatisfactory result.

---

*The following are the figures of the 1924 census of coconuts in Malaya.

| Federated Malay States. | | Straits Settlements. | | Unfederated Malay States. | |
|---|---|---|---|---|---|
| Perak | 75,281 acres | Singapore | 6,565 acres | Johore | 92,500 acres |
| Selangor | 62,117 „ | Malacca | 45,000 „ | Kedah | 27,550 „ |
| Negri Sembilan | 6,604 „ | Dindings | 6,000 „ | Kelantan | 70,900 „ |
| Pahang | 19,400 „ | Province Wellesley | 55,000 „ | Trengganu | 8,000 „ |
| | | Penang | 15,000 „ | Perlis | 2,578 „ |
| Total F.M.S. | 163,402 acres | Total S.S. | 127,565 acres | Total U.M.S. | 201,528 „ |

Total Malaya 492,495 acres.

### Federated Malay States.

Records were obtained of 87,507 coconut holdings in the F.M.S. Of these 41,246 are in Perak, 22,610 in Selangor, 11,478 in Negri Sembilan and 12,173 in Pahang.

Of the large estates, 28 exceed 1,000 acres each, two of which exceed 5,000 acres each; 54 are between 100—1,000 acres each; 2,048 are between 5 and 100 acres each; and 21,005 under 5 acres each. The number of small holdings of mixed cultivation, including coconuts, number 64,372.

A summary of the areas under coconuts in the F.M.S. is given in the accompanying table. The figures for areas under 100 acres each include the counts of trees in mixed holdings which are here computed in acres on the basis of 50 palms per acre. These mixed areas amount to an estimated area of 16,487 acres immature and 29,511 acres mature coconuts. These areas may be considered as "ineffective" as the yields in most cases are small and are generally utilised locally. The "effective" area under coconuts in the Federated Malay States is therefore 55,582 acres immature and 138,150 acres mature.

### Straits Settlements.

Administrative difficulties precluded an accurate census of the area under coconuts in Singapore island. The area, however, is not sufficiently great to affect the value of the returns from the Colony.

Excluding Singapore, particulars of the areas of 49,603 owners were received from the Straits Settlements and were analysed. Of these, 7 are estates of between 1,000 and 2,000 acres each; 56 are estates of from 100 to 1,000 acres each; 1,000 are holdings between 5—100 acres each; there are also 6,403 holdings under 5 acres and 42,137 small holdings of coconuts mixed with other trees.

Of the total area under coconuts in the Colony, 5,662 acres immature and 28,305 acres mature represent the esimated "ineffective" areas of small holdings of mixed cultivation. The "effective" coconut area in the Straits Settlements is therefore 6,184 acres immature and 41,896 acres mature.

### Unfederated Malay States.

*Kedah.* The returns from this State are reasonably complete. The total number of coconut holdings is 36,129 of which no less than 35,659 are small holdings of coconuts and other trees. On a basis of 50 palms per acre the number of coconuts contained on such holdings would be represented by 7,981 acres immature coconuts and 15,528 acres of mature coconuts. The estimated total area of coconuts in Kedah is 26,688 acres of which 8,814 acres are immature and 17,874 acres mature. There are but 5 estates of over 100 acres each, the largest being less than 300 acres.

*Perlis.* There are no large coconut estates in Perlis. In addition to the areas of coconuts unmixed with other forms of cultivation, 49,939 immature and

101,777 mature palms were counted on holdings containing other trees also. The area represented by these palms has been computed at the rate of 50 palms per acre.

*Johore.* The Principal Agricultural Officer, Johore, is responsible for the coconut returns from that State. The following facts are drawn from his report on this subject.

The chief difficulties encountered were that neither land alienation nor the headman system were sufficiently perfect and a large number of coconut holdings are still unsurveyed.

Consequently, the coconut census forms prepared for this work could not be used in Johore. The estimate was prepared by production of a map shewing distribution of coconut areas; examination of figures for the export of copra from various district; and the examination of various agricultural records.

There are 90,750 acres of mature coconuts and 29,350 acres of immature coconuts contained in large areas. The produce from such areas is mainly available for export.

Of large areas of coconuts mixed with rubber, fruit trees and other forms of cultivation, there are 41,250 acres mature and 3,700 acres immature. It is estimated that the yield capacity of such areas is from 20—40 per cent. of similar areas of coconuts alone growing under corresponding conditions.

There are very few large coconut estates in Johore. Twelve estates only are said to have an area exceeding 100 acres each. One of these estates exceeds 1,000 acres and one has between 600—700 acres.

Areas of scattered palms are found in great numbers. The produce of such palms is absorbed locally and none is available for export. No estimate of the acreage represented by this "ineffective" area has been attempted.

It is estimated that there are 30,000 individual coconut holdings in Johore and that the number of coconut palms is in the neighbourhood of 7,000,000 of which 5,000,000 are mature.

*Kelantan.* Records have been received of particulars of 40,072 holdings containing coconuts. The total number of trees on such holdings amounts to 287,990 immature and 742,674 mature palms, in addition to an area of coconuts unmixed with other crops of 1183 acres. On a basis of 50 palms per acre, this is equivalent to 21,797 acres.

The Kelantan Government estimates the total area at 57,271 acres. The 1929 exports of copra from the State amounted to 122,187 piculs (7,187 tons). In view of the fact that records exist of nearly 6,000 acres of immature palms, that there are no large coconut estates—in fact that much of this copra must originate from small holdings of mixed cultivation—it may safely be assumed that the official returns are not over-estimated.

*Trengganu.* Owing to the undeveloped condition of this State, reliable statistics could not be obtained. Apart from one estate, the coconut holdings are small and frequently interplanted. The figure of 25,000 acres must be considered as little more than an approximate estimate.

# AREA OF COCONUTS IN MALAYA 1930.

| | STATE OR TERRITORY. | IMMATURE. On Holdings of | | IMMATURE. Total Immature area (Acres). | MATURE. On Holdings of | | MATURE. Total Mature area (Acres). | Total (Acres). |
|---|---|---|---|---|---|---|---|---|
| | | Over 100 acres each. | Under 100 acres each. | | Over 100 acres each. | Under 100 acres each. | | |
| *Federated Malay States.* | Perak ... ... ... | 11,476 | 14,196 | 25,672 | 37,664 | 45,604 | 83,268 | 108,940 |
| | Selangor ... ... ... | 5,398 | 35,519 | 40,917 | 32,429 | 36,948 | 69,377 | 110,294 |
| | Negri Sembilan ... ... | 155 | 1,121 | 1,276 | 914 | 3,776 | 4,690 | 5,966 |
| | Pahang ... ... ... | 256 | 3,948 | 4,204 | 2,456 | 7,870 | 10,326 | 14,530 |
| | Total F.M.S. ... | 17,285 | 54,784 | 72,069 | 73,463 | 94,198 | 167,661 | 239,730 |
| *Straits Settlements.* | Singapore ... ... ... | ... | ... | ... | 3,159 | 4,841 | 8,000 | 8,000 |
| | Malacca ... ... ... | ... | 2,330 | 2,330 | ... | 10,255 | 10,255 | 12,585 |
| | Dindings ... ... ... | 893 | 1,696 | 2,589 | 1,764 | 2,177 | 3,941 | 6,530 |
| | Province Wellesley ... | 2,183 | 1,438 | 3,621 | 15,415 | 17,785 | 33,200 | 36,821 |
| | Penang ... ... ... | 308 | 359 | 667 | 2,936 | 9,923 | 12,859 | 13,526 |
| | Labuan ... ... ... | ... | 1,958 | 1,958 | ... | 1,238 | 1,238 | 3,196 |
| | Brunei ... ... ... | ... | 681 | 681 | ... | 689 | 689 | 1,370 |
| | Christmas Island ... ... | ... | ... | ... | ... | 19 | 19 | 19 |
| | Total S.S ... | 3,384 | 8,462 | 11,846 | 23,274 | 46,927 | 70,201 | 82,047 |
| *Unfederated Malay States.* | Johore ... ... ... | 428 | 32,622 | 33,050 | 2,873 | 129,127 | 132,000 | 165,050 |
| | Kedah ... ... ... | 361 | 8,453 | 8,814 | 492 | 17,382 | 17,874 | 26,688 |
| | Perlis ... ... ... | ... | 1,434 | 1,434 | ... | 2,527 | 2,527 | 3,961 |
| | Kelantan ... ... ... | ... | ... | ... | ... | ... | ... | 57,271 |
| | Trengganu ... ... ... | ... | ... | ... | ... | ... | ... | 25,000 |
| | Total U.M.S. ... | ... | ... | ... | ... | ... | ... | 277,970 |
| Grand Total ... | Malaya ... ... ... | | | | | | | 599,747 |

## Conclusions.

The area of coconuts in Malaya is approximately 600,000 acres. Of this area about one-fifth consists of estates of over 100 acres each. The proportion of immature to mature coconuts is about one-sixth.

Of estates over 1,000 acres each there are 28 in the Federated Malay States, 7 in the Straits Settlements and one in Trengganu.

In all parts of the Peninsula are to be found small holdings of mixed cultivation and small groves of coconut palms. These are mainly used to satisfy local demand and are not as a rule of economic importance. In the Unfederated Malay States, however, and particularly in Kelantan, a considerable amount of copra originates from such areas.

Local consumption, coconut oil exports, exports of fresh nuts and immature areas are represented by about 200,000 acres, leaving approximately 400,000 acres to produce the Malayan export of copra. Allowing an under-estimate in this census of area under this crop of 10 per cent. the mature area therefore gives an annual crop of 4.6 picul (about 600 lbs.) per acre.

# EXPERIMENTAL WORK IN RELATION TO OIL PALMS.*

BY

B. BUNTING,

*Agriculturist.*

## Introduction.

In view of the increasing importance of the oil palm industry in Malaya the Department of Agriculture, S.S. & F.M.S. has devoted a considerable amount of attention to practical investigations connected with the cultivation of this comparatively new crop to Malaya.

A fairly large experimental area has been planted with oil palms at the Experimental Plantation, Serdang for the purpose of investigating the various problems concerning the cultivation of this crop on a plantation scale, and it is proposed in this paper to give a brief account of the experimental work now being carried out by the Agricultural Division of the Department both at the Experimental Plantation, Serdang and on estates owned by public companies.

## Seed Selection.

Although male and female inflorescences are produced separately on the same palm it is extremely rare to find both male and female inflorescences on a single palm simultaneously in a condition suitable for pollination. Consequently, the natural tendency of the palm is to become cross-fertilised with pollen from another palm and when it is required to "self" a particular palm it is invariably necessary to keep the pollen for long and indefinite periods until a female inflorescence becomes receptive. This means that the stored pollen has frequently lost its viability by the time the female inflorescence is ready to receive it, with the result that self-pollination by artificial methods is not very successful.

Experiments have been carried out at Serdang in the crossing and "selfing" of ten of the highest-yielding palms growing under avenue conditions with the result that to-date 69 distinct crosses and 4 "selfs" have been successfully established from known parentage. Arrangements are now being made to plant half-acre plots of each cross and "self" on a field scale in Blocks 10a, 17 and 18 in order to ascertain whether the high-yielding characters of the parents, grown under avenue conditions, are maintained in the progeny when grown under normal plantation conditions. Control palms, which have been produced under ordinary estate conditions, will be planted between every four rows of the selected palms for purposes of comparison when the palms come into bearing.

* Paper read at the Second Inter-Departmental Agricultural Conference held at Kuala Lumpur in October, 1930.

Records have been kept of the individual yields of the palms from which the various crosses were produced. These records were commenced when the parent palms first began to fruit in August, 1924 and are being continued.

It is fully realised that too much significance cannot be attached to the abnormally high yields which have so far been recorded on palms growing under somewhat exceptional conditions. In consequence, this experiment will be repeated with crosses from high-yielding palms growing under normal plantation conditions. With this object in view, an area of about 2 acres of palms planted in November, 1924 has been selected in Block 21; the yield of fruit has been recorded from each individual palm in this area since January, 1929 when the palms came into bearing. It will, however, be necessary to take records of such yields for a number of years before selecting the highest yielding palms for this purpose.

### Introduction of New Varieties.

With a view to obtaining improved types of oil palm, the Department introduced during 1926 no less than 40 different lots of seed from the various palm oil producing countries in West Africa.

An area of 33 acres in Block 19 has been devoted to varietal trials and 32 plots, varying from ½ to 1 acre of each variety, were planted in this area between November, 1927 and April, 1928. These palms are now commencing to fruit and it will be most valuable to make a comparison of the different types of fruit produced with such a varied selection of palms cultivated under the same conditions.

It may be of interest to record that included in the collection is the "mantled" type, the pericarp of which is covered with sterile carpels containing oil. The entire fruit is stated to contain a higher percentage of pericarp oil than is found in the ordinary "Deli" type commonly planted in the East Indies.

The establishment of such a varied collection of palms should prove of great value in future work on seed selection, which will eventually be carried out at Serdang in collaboration with the Botanical Division of the Department.

### Cover Crops and Green Manures.

The advantages of cultivating a low-growing cover plant on hilly or undulating land for the prevention of soil erosion cannot be disputed, but experiments carried out at Serdang indicate that, with oil palms growing on flat land, not liable to soil wash, such cover plants have a tendency to retard fruit production.

An area of young oil palms in Block 21 has been planted in 1 acre plots with *Calopogonium mucunoides, Centrosema pubescens, Tephrosia candida* and *Crotalaria anagyroides* and an equal area is reserved for clean-weeded controls. The covers were removed during 1929 and the yields of fruit from the various plots have been recorded since that date.

The records for the period 1927-to 1929 show that the total yield of fruit

from the clean-weeded plots is slightly in excess of that obtained from the plots formerly under cover crops and green manures as detailed below :—

| | *Number of bunches.* | *Weight of cleaned Fruit.* |
|---|---|---|
| (a) Cover plants ... | 7,031 | 65,469 lbs. |
| (b) Clean-weeded control... | 9,326 | 79,231 lbs. |

Although these experiments are probably insufficiently advanced to give definite information as to the effect of covers on the ultimate yield of oil palms, the tendency at present is in favour of clean weeding on flat land.

Another serious objection to the cultivation of low-growing cover crops such as *Calopogonium mucunoides* and *Centrosema pubescens* is the danger of harbouring vermin, notably rats, which have become a very serious pest on the majority of oil palm estates in this country.

### Germination.

Further experiments are being conducted at Serdang to compare the germination of seeds obtained from bunches harvested as in estate practice with that of seed obtained from fallen fruit. The results so far do not indicate that seed taken from fallen fruits give a higher percentage germination than seed harvested in the ordinary way. These experiments will be repeated on a larger scale at a later date if necessary.

There is no doubt that the germination of oil palm seed is liable to wide variation and whether this is due to the method of harvesting the fruit or to other causes requires closer investigation.

### Interplanting Rubber with Oil Palms.

On the recommendation of the Agricultural Advisory Committee, an experiment was laid down on an area of approximately 9 acres in Block 20B at Serdang to test the effect of interplanting oil palms with rubber.

The area was planted with oil palms 30 ft. x 30 ft. triangular, or 56 palms per acre, in January, 1926 and afterwards interplanted with an equal number of rubber stumps per acre.

The following measurements, taken in January, 1930, show the development of the palms in this experiment compared with that of palms planted as a sole crop in a similar area in Block 5A :—

| | *Block 20B.* | *Block 5B.* |
|---|---|---|
| Average height ... ... | 15 ft. | 20 ft. |
| ,, spread ... ... | 20 ft. | 28 ft. |
| ,, circumference ... | 6½ ft. | 8 ft. |

The following measurements, taken in October 1930, show the development of the rubber in this experiment :

| | |
|---|---|
| Average height ... ... ... ... | 30 ft. |
| Average circumference at 2 ft. from ground | 19 inches |

The growth of the rubber has obviously been retarded by the more rapid development of the oil palms, which so far appear to have a decided advantage over the rubber trees.

### Pruning of Leaves.

Experience has shown that the pruning of the leaves of young oil palms should be restricted to the removal of those leaves which have dried and therefore ceased to function. If this practice is adopted it will result in the young palms forming a good-sized trunk, thus providing a suitable base for future development.

In order to test the effect of excessive pruning of the leaves of palms in bearing, an area of approximately 2 acres was selected in Block 5D at Serdang. There were 100 five-year old palms included in this experiment and these were divided in four equal plots as follows :—

Plot 1 = 25 palms, pruned at the rate of 3 leaves per month.
Plot 2 = 25 do. 2 do.
Plot 3 = 25 do. 1 do.
Plot 4 = 25 „ control (normal pruning).

The experiment proved that the removal of three leaves per month was far too drastic, and after a period of 18 months this system of pruning had to be abandoned; even the removal of two leaves per month was considered excessive, since the palms tend to produce new leaves more rapidly and to increase in height at the expense of girth. On the other hand, the removal of one leaf per month was insufficient and resulted in dead leaves accumulating on the palms. The operation of pruning should, therefore, be restricted so as to allow of harvesting the fruit bunches and the removal of any dead leaves.

A further experiment to test the effect of (a) normal, and (b) minimum pruning of leaves on the yield has been laid down on an area of about 4 acres in Block 21. There are 252 palms included in this experiment, the two forms of treatment being alternated in 36 rows of 7 palms each.

The ill-effect of excessive pruning is now generally recognised and, in order to conserve the energies of the palm, only the minimum amount of pruning should be carried out.

### Removal of Female Inflorescences from Immature Palms.

The harvesting of fruit bunches should be deferred until the palms are at least 4 years old, although a large number of small bunches are produced when the palms attain the age of 2½ to 3 years. As these are allowed to remain on the palms until they become over-ripe and fall, they are not only liable to attract rats but may become a possible source of infection of *Marasmius* or other fungoid diseases affecting fruit bunches.

Because of the possible dangers attending the premature production of fruit bunches, an experiment was started on an area of approximately 8 acres in Block 20B to test the effect of the removal of female inflorescences before regular harvesting of fruit commenced. The experiment was made on 480 palms and the female inflorescences were removed from every alternate row from August, 1928, to December, 1929 the intermediate rows being retained as controls.

The results show that there has been no increase in the number of inflorescences produced as a result of removing the female inflorescences. Further, the development of the treated palms has not been affected in any way and has been very similar to that of the untreated controls. Records of the yield of fruit bunches are now being taken from the series of plots in order to ascertain whether there has been any conservation of vigour in the palms which were prevented from fruiting in the early stages of development (by the removal of all female inflorescences as soon as they appeared).

## Manuring.

It is now realised that the question of manuring oil palms will have to be considered as the palms become older, if satisfactory returns are to be obtained.

At present, little is known about the manurial requirements of the palm. With a view to investigating this important subject the Department has inaugurated a scheme of experiments which is now being carried out on blocks of about 8 acres on Tennamaram Estate, Batang Berjuntai; 4 acres on Elmina Estate, Sungei Buloh and 2 acres at the Experimental Plantation, Serdang.

In these experiments each block is limited to 120 palms divided into six plots of 20 palms each. A guard row of palms separates one plot from the other, but the yield of fruit from the guard rows is not recorded since they are only included to ensure proper isolation of the various plots in the experiment.

In order to obtain a measure of the respective yields of fruit obtained from the different plots, preliminary observations were made of the production of fruit bunches from each individual palm comprised in the experiment for a period of $1\frac{1}{2}$ years. The preliminary records before manurial treatment were commenced in January, 1929 and completed in June, 1930. A statistical examination of the figures obtained showed that it was necessary to reduce the size of the plots in each case from 20 to 10 palms, thus providing 12 plots in each block instead of 6 as originally arranged.

After completing the preliminary records, all the plots were lightly cultivated and artificial manures were applied to eight plots in July, 1930, the remaining four plots in each block being retained as controls.

There are two blocks under trial on Elmina Estate and four blocks on Tennamaram Estate, which gives four and eight replications respectively on each estate. The manurial treatment for each block on these estates is as follows :—

2 plots = Nitrogen, phosphate and potash.
2 „ = Nitrogen and phosphate.
2 „ = Phosphate and potash.
2 „ = Nitrogen and potash.
4 „ = Controls (untreated).

It was decided in the first instance that quick-acting mineral manures should be applied and that the standard mixture should consist of 2 lbs. of suphate of ammonia, 6 lbs. of superphosphate (18 to 20 per cent.) and 2 lbs. of sulphate of potash, divided into two applications at intervals of six months, namely in July and January.

The plots are randomised in order to check any variation in soil conditions so that the manurial treatment of the similarly numbered plots in each block is not necessarily the same.

For convenience of record, arrangements were made to harvest the fruit on these plots at regular intervals of 7 days and an officer of the Department visits both estates weekly and takes records of the yield of fruit bunches from each individual palm in the experiment.

A similar scheme of experiments was laid down in Block 21 at Serdang in January, 1929. The preliminary records of yields on these plots, although showing considerably less variation than those of the plots on the two estates mentioned above, indicated the necessity for reducing the size of the plots from 20 to 10 palms per plot in order to reduce the experimental error.

The scheme of manuring on this block differs slightly from that carried out on the estates in order to allow of three replications of the manurial treatment, which is as follows :—

3 plots = Nitrogen, phosphate and potash
3 „ = Phosphate and potash
3 „ = Phosphate
3 „ = Controls (untreated)

The standard mixture was the same as that used on the estates, namely 2 lbs. sulphate of ammonia, 6 lbs. superphosphate (18 to 20 per cent.) and 2 lbs. sulphate of potash, divided into two applications at intervals of six months. The first application was made during August, 1930 and the halves of the guard rows on each side of the manurial plot received the same manurial treatment as the plot itself.

Since it is proposed to manure the plot every two years, it should be possible either to increase or reduce the respective quantities of nitrogen, phosphate and potash, or alternatively, to substitute other forms of nitrogen, phosphate or potash while still retaining the original combination of plant nutrients in the respective plots.

It will be realised that the present scheme of manuring is purely experimental and that it may be found necessary to make considerable changes in the programme as further information is obtained.

## Artificial Pollination.

There are considerable differences of opinion amongst planters as to the necessity or otherwise of carrying out artificial pollination of oil palms in order to obtain the maximum yield of fruit.

The Department has given careful attention to this important problem and much valuable information has been collected as a result of the experiments which have been carried out, both at the Experimental Plantation, Kuala Lumpur and later at the Experimental Plantation, Serdang.

An experiment in the artificial pollination of oil palms, growing under avenue conditions, has been in progress at Serdang since August, 1924. The palms in this experiment were planted in May, 1922. The distance of planting is 30 feet apart while the two rows forming the avenue are situated 36 feet apart. The first male spadix appeared in May, 1923 and the first female inflorescence early in December 1923.

The palms were divided into two blocks and forty-three palms on one side of the avenue were pollinated artificially, while a similar number of palms on the opposite side of the avenue served as controls. Artificial pollination was carried out from the 1st. August, 1924 and records of the yield of fruit from each individual palm have been taken since January, 1925. It should be stated that in this particular experiment artificial pollination is restricted to one female inflorescence per month as a maximum.

The following is a summary of the yields of (a) the weight of fruit bunches and (b) the weight of cleaned fruit from the two sets of palms for the period 1925 to 1929 :—

| | *Artificially Pollinated* | *Naturally Pollinated* |
|---|---|---|
| | *lbs.* | *lbs.* |
| Weight of bunches ... ... | 39,287 | 15,498 |
| Weight of cleaned fruit ... ... | 25,707 | 5,965 |

It will be seen from these figures that the pollinated palms show 15 per cent. increase in the weight of bunches and 330 per cent. increase in the weight of cleaned fruit over the unpollinated control.

Whereas too much significance cannot be attached to the wide difference in the yield due to the artificial pollination of young palms growing under avenue conditions, the results obtained from this experiment have been of material value in the laying out of further experiments in the artificial pollination of palms growing under normal field conditions.

An experiment in the artificial pollination of oil palms growing under field conditions was started in Block 5D at Serdang in January, 1926 on an area of approximately 20 acres of palms planted 30 ft. x 30ft. triangular in May, 1922. In this experiment the pollinated and control palms are in alternate rows in the

area under experiment. There are 68 rows of palms included in the experiment and the odd numbered rows are pollinated artificially, while the even numbered rows serve as controls. Artificial pollination was commenced in January, 1926 and has been carried out continuously since that date.

The palms receiving artificial pollination are patrolled every alternate day and a maximum of one female inflorescence per palm is pollinated every five weeks, which gives approximately ten pollinations per palm per annum. The fruit bunches are harvested every 7 days and a monthly record has been kept of the total number and weight of fruit bunches of (a) the artificially pollinated palms and (b) the unpollinated palms since October, 1926.

The following figures show the total weight of fruit bunches obtained from each plot for the period October, 1926 to June, 1930 :—

| *Year.* | *Pollinated Palms.* | *Control Palms.* | *Increases.* |
|---|---|---|---|
| | lbs. | lbs. | (per cent.) |
| 1926 (3 months) ... ... | 7,979 | 3,371 | 136.6 |
| 1927 ... ... ... | 37,234 | 18,061 | 106.1 |
| 1928 ... ... ... | 63,870 | 28,912 | 120.9 |
| 1929 ... ... ... | 91,645 | 49,806 | 84.0 |
| 1930 (6 months) ... ... | 62,656 | 29,581 | 111.1 |
| Total | 263,384 | 129,731 | 103.0 |

During the above period the pollinated palms produced 14,514 fruit bunches giving an average weight of 18.1 lbs. per bunch, whereas the unpollinated control palms produced 11,737 fruit bunches giving an average weight of 11.1 lbs. per bunch or a difference of 7.0 lbs. per bunch in favour of the artificially pollinated palms.

The results clearly indicate that a considerable increase in fruit production is obtained by adopting artificial pollination in the case of young palms. It is intended to continue the experiment in order to ascertain whether this large increase in yield, due to artificial pollination, is maintained as the palms increase in age.

The ill-effects of over-pollination are now being recognised in estate practice and on some estates where the area was formerly patrolled regularly every three days for artificial pollination this interval has now been increased to seven days without any adverse effect on the yield of fruit.

It is considered that if artificial pollination can be restricted to the pollination of only one female inflorescence per month on each palm, far better results would be obtained and the crop would tend to be more evenly distributed. An experiment with this object in view has been started in Block 21 at Serdang. In this experiment the effect of pollinating (a) six, (b) twelve, and (c) all female inflorescences annually is being compared with (a) unpollinated control. This experiment is not sufficiently advanced to show the effect of the various treatments.

## Harvesting of Fruit.

Although the oil palm commences to fruit about the third year after planting it is not advisable to commence harvesting until about the end of the fourth year.

The bunches of fruit are usually ripe and ready for harvesting within a period of 5½ to 6 months from the date of pollination, but if a dry spell of weather intervenes during the latter stages of development this period may be extended for about another month. The fruit ripens throughout the year but the crop during the highest yielding months, August and September, may be from three to four times that of the lowest yielding months, January and February.

The bunches are ready for harvesting when several fruits in the crown become loose and can easily be removed. The importance of harvesting only ripe bunches cannot be emphasised too strongly, since the collection of either unripe or over-ripe fruit will not only result in a serious loss of oil, but will cause an increase in the content of free fatty acids in the oil.

Previously, the harvesting at Serdang was carried out twice a week, but the tendency was to harvest immature bunches with the result that it was found difficult to separate the fruit from the bunches. Harvesting is now being carried out once a week and the bunches are harvested six days before the cleaned fruit is treated in the factory.

Harvesting the bunches and allowing them to ripen at the base of the palm doubled the acidity of the oil and it was found necessary to erect collecting sheds in the field so as to protect the fruit from rain.

The average weight of a bunch over the whole plantation for the first 8 months of the year 1930 was 15.6 lbs. and at present about 50 per cent. of this represents cleaned fruit. The amount of oil recovered is approximately 25 per cent. of the weight of cleaned fruit.

## Conclusions.

Although it is too early to form any definite conclusions on the experimental results so far obtained, considerable progress has been made in many directions from a practical standpoint and this information is now being successfully employed in general estate practice throughout the country.

# CONTROL OF MOULDY ROT DISEASE OF RUBBER.

BY

F. BEELEY, B. SC. (LEEDS)

*Field Officer, Rubber Research Institute of Malaya.*

In an account in the Quarterly Journal of the Rubber Research Institute, Vol. 1, No. 4 of the occurrence and life history of the casual fungus *Sphaeronema fimbriatum* (E and H.) Sacc., the importance of maintaining an open, healthy, dry atmosphere within the plantation is emphasised. Thinning out to a less dense stand of trees per acre, good drainage, clean weeding or low growing cover crops where such are necessary to preserve top soil on hill slopes, ring weeding such trees, shallow tapping during wet weather, clean knives, cups and spouts, and the occasional sterilisation of all utensils used in tapping are factors which tend to minimise the possibility of occurrence of the disease.

It is further pointed out that optimum growth of the fungus takes place at temperatures from 22°C to 26°C while at a higher temperature growth is retarded until at 35°C the fungus is killed. If follows, therefore, that in a small holding were secondary jungle growth, 'lalang' grass and high weeds are present, the temperature of the damp bark surface being about 25°C, the fungus will be more vigorous and cause far greater damage than would be the case if the area was clean weeded to enable the bark surfaces to become dry.

One of the essential points in the treatment of Mouldy Rot is that the weeds or covers be closely slashed, or that clean weeding be adopted.

It is known also that Mouldy Rot is less active in dry weather than in wet weather. Attention to drainage will not only aid in controlling the disease, but will greatly improve the trees. Having given the necessary attention to the sanitary conditions within the holding, the affected trees must next be considered.

Firstly, all bark scrap should be removed before applying fungicide. The vertical channel, spouts and cups should be cleaned and overflowed rubber on the panel below the cut should be removed. Films of coagulated latex serve as a medium and protective cover for the fungus through which the disinfectant may not penetrate. Tappers on infected areas should have their knives and utensils sterlised and all trees in other areas tapped by the same tapper should be sprayed with one of the preventive sprays mentioned below.

Having cleaned the panel and burned all infective scrap material, the disinfectant may then be applied. The method of application and area of panel to be disinfected requires careful consideration.

Where the disease has been present for several days or longer, it is likely that rain has washed numerous spores into the interstices of the bark below the cut and the bark near the vertical conducting channel. It is, therefore, almost useless to paint a narrow strip of the renewing bark, and the best result which may be expected from this method is merely that of temporary relief. Experiments in heavily infected small holdings have repeatedly demonstrated the use-

lessness of strip painting.

In order to eradicate the disease it is essential to spray all the panel to the ground from a point some 12 inches above the cut, including the vertical channel. It will be realised that the use of a brush, coconut husk or rag will make this procedure somewhat tedious, wasteful of time and material, and ineffective. The most economical, rapid and efficient method is to use a small hand sprayer, or if large areas are to be treated, a knapsack sprayer fitted with a fine spray jet. A fine spray will penetrate into the interstices of the bark and will enable the operator to cover a larger area in a given time, while the quantity of liquid used is less than by other methods and the disease is less likely to reappear owing to the more thorough disinfection of the bark.

It is desirable that infected trees be taken out of tapping for one month, but circumstances may arise where tapping is essential to maintain the yields of the estate for commercial purposes; in which case, freshly cut portions of the panels must be painted with disinfectant after each tapping, following the proper treatment.

The following disinfectants may be used in the manner described :—

*Izal.*—A 3 per cent. mixture of Izal in water may be used applied by means of a sprayer to the whole panel, giving three applications with one day interval between each. Tapping should be stopped for one month. If it is necessary to keep the trees in tapping, three applications should be given on the whole panel as above, and the freshly cut cortex should be painted each day for one month at the time the latex is collected.

*Brunolinum Plantarium.*—A 5 per cent. mixture should be applied in the same manner as described for Izal. A little methylene blue (1 oz. in 10 gals.) added to the above colourless disinfectants will assist in checking the work of disinfection.

*Agrisol.*—A 5—10 per cent. mixture in water should be applied as described for Izal. If the weather is wet, the stronger mixture should be used.

*Cargilineum B. Mixture (10 per cent.)*—This is an "insoluable" compound withstanding wet weather. It is in paste form and cannot be applied by spraying; a brush must be used. The applications, covering as much of the panel as possible, with an interval of 7 days, have given results equal to those obtained by using the water miscible disinfectants described above. If tapping is to be continued, the freshly cut cortex must be painted with the disinfectant each tapping day for one month.

If the weather is wet, or as an additional precaution, the water miscible disinfectants may often be followed with advantage by a coating of water-

proof disinfectant medium applied to the affected panel some 6 inches above and below the cut. Four such water proofing mixtures are as follows :—

50 per cent. Asphaltum, 10 per cent. Brunolinum 40 per cent. Kerosene.

10 per cent. Brunolium in 90 per cent. Tar.

10 per cent. Solignum in 90 per cent. Tar.

Cargilineum Mixture " B " 10 per cent.

Any of these four mixtures may take the place of the third application of the water miscible disinfectant, and should be applied only when the surface of the panel is dry.

## Selected Article.

# SISAL FOR TEXTILE AND ALCOHOL INDUSTRIES.*

BY

Percy Ripley.

The history of sisal, if we use the name to include all members of the agave family of plants, extends over a century or so, and indeed, desultory cultivation by pioneers curious as to the plant's properties is recorded as far back as the end of the eighteenth century. But sisal received little attention from a practical point of view until within the last fifty years, and even at the present time its commercial possibilities have been explored only in a few directions. Sisal is a generic term, and it should be explained that when sisal is named without qualification the reference is to *Agave sisalana*, as distinguished from the Mexican plant henequen and its several varieties, all really members of the sisal family, and as distinguished also from the hemps of Manila, Mauritius, and New Zealand, which also belong to the same natural order as sisal.

A hardy plant, requiring little cultivation, resistant to the attacks of most diseases and to all but the most voracious of animals, sisal originated in Central America, from which it has been introduced into some thirty countries. Its cultivation in many of these countries, which are situate in four continents, is still at an experimental or relatively unimportant stage. Such is the stage reached in Australia and Malaya; in other areas, as, for example, the Caicos Islands, the cultivation of sisal, though on a comparatively small scale, has proved a valuable addition to the scanty means of livelihood otherwise available to the inhabitants.

Africa is the most important producer of sisal, and notably Tanganyika and Kenya. Exports of sisal from East Africa during 1929 were of a value of over £2,000,000, and further expansion in exports is only a matter of the provision of additional capital for the development of estates. The introduction of sisal to Africa was the result of German foresight, and until the war the cultivation of sisal was a part of German colonial policy. Since the war the industry has passed largely under British control; many of the sisal plantations in Kenya and Tanganyika are owned by private planters, but some of the largest estates in Tanganyika are owned by British joint stock companies.

### Raw Material for Cordage.

Sisal is used chiefly for the manufacture of cordage; its chief competitors are henequen and Manila hemp, both of which have been longer in that commercial field where hard fibres are required. The great harvesting countries are

*Reprinted from The Commercial Textile, Engineering, and Financial Review. November 20,1930. Published by the "Manchester Guardian."

large consumers of cordage, or rather of binder twine. The United States and Canada derive from Mexico far and away the greater part of their supplies of twine or material to make twine, though they also receive a sprinkling of supplies from Java, a fairly important producer, and Cuba.

It is to be regretted that Canada derives hardly any of its binder material from Empire sources; the annual value of its imports from Mexico (in the form of re-exports from the United States) and elsewhere is equal to about £1,750,000. Eighty per cent. of the United Kingdom's supplies of hard fibres come from Manila and New Zealand. So far neither Tanganyika nor Kenya have found difficulty in disposing of their crops of sisal—at least, not until the world-wide commercial depression now prevailing. Belgium is apparently a considerable importer of sisal from these two sources, but it may be assumed that a large quantity of the Belgian imports is in transit to Germany. The growth of the productions of Tanganyika and Kenya in recent years and the acreages under cultivation in Kenya will be seen from the tables following:—

| | 1913. | 1923. | 1928. | 1930. |
|---|---|---|---|---|
| Production. | Tons. | Tons. | Tons. | Tons. |
| Tanganyika ... | 21,000 | 12,845 | 36,186 | *25,863 |
| Kenya ... | 211 | 8,543 | 16,516 | †6,004 |

* Seven months. † Five months.

| | 1313. | 1923. | 1929. | 1930. |
|---|---|---|---|---|
| Acreage. | | | | |
| Kenya ... | 7,000 | 39,026 | 109,385 | — |

An agricultural census is not taken in Tanganyika, but probably the area devoted to sisal is not less than 150,000 acres. It will be noticed that the production of Tanganyika in 1923 was considerably less than for 1913. This is to be explained by the disorganisation caused by the war and the passing of estates into the hands of fresh owners. Additionally, it must be added that even sisal did not escape the excesses which characterised business conditions in 1920, and extravagant hopes and actions were followed by the inevitable result. It will be seen, however, that the production of sisal in Tanganyika has more than trebled during the last six years, and this is the more notable in view of the fact that the production of Mexican henequen has greatly decreased during the last three years.

Sisal is ordinarily not harvested until the fourth year, but there is no universal practice, and soil and climate cause local variations in the period. Harvesting consists only of the cutting of a portion of the leaves, taking the lower and oldest leaves first; this process is continued for about eight years, when the life of the plant comes to an end. East African sisal leaves are credited with a yield of 3½ per cent. of fibre, or from 60lb. to 80lb. of fibre per 1,000 leaves. The return from Mexican henequen would be approximately 1 per cent. greater than this. If these figures represented the latest achievements, then henequen would have only a small advantage in yield; as a matter of fact, higher yields than 3½ per cent. of dry fibre are common on well-managed East African estates. The latest

returns from three representative East African estates show yields of 4.3 per cent. 4.25 per cent., and 4.69 per cent. Modern fertilising methods have been scarcely applied to the cultivation of sisal in East Africa; there is little doubt that scientific manuring would result in more rapid growth and higher yields.

The British-controlled sisal estates are administered more in accordance with the best modern practice than are the Mexican henequen estates, both with regard to general organisation and the care of labour. Until quite recently the Mexican industry suffered from the handicap that cultivation has been in the hands of a multitude of small owners; efforts have been made to correct this defect by means of co-operative societies, and the Mexican Government has taken steps to bring about the standardisation of the product. East African sisal, however, remains a finer product, partly owing to different methods of cultivation and selection of plants and partly owing to greater efficiency in prepration, scrupulous care being taken to remove all impurities.

The superiority of East African sisal is recognised in the market price, which is normally about 10 per cent. higher than that for henequen. Indeed, a glance at East African sisal shows it to be beautifully clean, and it has an attractive "feel." It is rather surprising that sisal has not yet been used in Great Britain for delicate work, particularly as Mexican peasants have succeeded in producing articles of almost silken appearance from henequen. Probably, sisal will find it way into the textile world eventually; Lancashire, in its search for "fresh woods and pastures new," might do worse than explore the possibilities of this commodity. Incidentally, further development of the East African sisal industry should mean larger exports of piece goods as the purchasing power of the natives increases, so that Manchester might well have more than a casual interest in sisal production.

### Commercial Utility Proved.

Some may wonder whether possibly brotex or erbifex, regarding which so much is now heard, may not prove a rival to sisal. All that need be said at the moment on this point is that sisal has proved its commercial utility, and that the other fibres mentioned have yet to do this, though brotex seems to have been used successfully for the manufacture of paper. Sisal also lends itself to the manufacture of paper, and the fibre under the microscope is very similar to the fibre of esparto grass. Tests were carried out last year by an important firm of British paper manufacturers, and samples of paper were manufactured from sisal. The quality of the paper from sisal is not in question, but from a variety of circumstances the manufacture of sisal paper on a large scale is not at present an economic proposition.

The most important probable use for sisal waste is for the manufacture of alcohol. It was mentioned in the report on power alcohol issued during 1927 by the Department of Scientific and Industrial Research that experiments had shown that sisal waste from Kenya was highly favourable for fermentation,

either by itself or with less readily fermentable materials. The less readily fermentable materials might include maize cobs, inasmuch as maize is extensively grown in Kenya.

Important engineering firms have given special attention to the improvement of machinery for the treatment of sisal, including Robeys, of Lincoln, and the German firms of Krupp and Schilde, while many miles of light railways have been built by British specialists for the work of transport. The full benefits of the capital expenditure necessitated by these improvements have yet to be reaped, but on the three estates previously mentioned the c.i.f. cost of production has been reduced during the past four years from £32 per ton to £29 per ton. The price of No. 1 East African sisal was £35 10s. per ton at the end of 1929, against £42 per ton at the end of 1928; the current price is about £22 per ton, which reflects the drastic fall in commodity prices generally.

The provision of power for African sisal estates is still by oil engines, and it need hardly be said that the carrying out of the scheme for providing electrical power from the Great Pangani Falls in Tanganyika (which the British Government has recently sanctioned) will enable the costs of producing sisal in this area to be reduced considerably. Indeed, the provision of electrical power should greatly increase the ability of sisal-growers to compete with their rivals who cultivate similar plants in other lands. Africa has already passed the Dutch East Indies as a producer of hard fibres, and has taken the place of the world's third largest producer, ranking after Manila and Mexico. Probably Manila produces three and a half times and Mexico two and a half times as much hard fibres as Africa, so that, apart from new uses, Africa has plenty of fields to conquer in the matter of sisal supply.

# Abstracts.

## THE ACTIVE PRINCIPLE OF TUBA ROOT AND METHODS OF EXTRACTION.

*Investigations into the best methods of extracting the toxic principle of tuba root have been made in the Laboratory of the Division "Commercial Museum" of the Colonial Institute of the Netherlands at Amsterdam. The results have been published in "Contribution No. 26" which contains a report on the work of that body in 1929. The following is a translation of the portion dealing with this subject.*

Our correspondence on the subject of *Derris elliptica* shows that this crop has aroused much interest in the U.S.A. where there is a large demand for insecticides of organic origin which will lose their poisonous properties after some time so that they may be applied to vegetables, fruit, tobacco and such crops for which the use of arsenic compounds is considered undesirable.

For large scale application the organic insecticide should, however, be available in a convenient form of more or less stable consistency and strength and should always be obtainable in sufficiently large quantities at a reasonable price. The maximum price the consumer will be prepared to pay will of course depend greatly on its efficacy, which in its turn depends on the percentage of toxic principles which it contains.

Toxicity of tuba was formerly indicated by the collective name "derrid," an amorphous, yellow, resinous substance obtained by ether extraction. Now that Japanese scientists have separated from tuba a white, crystalline compound which they have called "rotenon" and which has proved to be poisonous, there is a tendency in Japan and in the U.S.A. to presume that this rotenon, so far as extractable and determinable, is the only active agent of derris root. But this is yet far from certain. Attempts to separate crystallized rotenon from the ether extract of Derris root from Sumatra were completely unsuccessful and yet the material was decidedly poisonous. One of the largest German manufacturers of insecticides is also of opinion that rotenon is not the only toxic ingredient of Derris root and may even not be the most poisonous ingredient.*

Chemical and biological investigators must collaborate further before the toxic ingredients have been determined beyond doubt; until then, either the ether extract or the rotenon determination will have to form the basis of judgment and this may lead to differences of appreciation of the same material.

The tests made in this country with Derris root supplied by the Commercial Museum, have confirmed the experience gained in other countries. For flowers

* As the roots of *Millettia* species W. & A. are used as a fish stunning agent in exactly the same way as derris roots and are considered to be equally efficacious, it might be worth while—(if its toxic agent is still unknown)—to examine the ether extract of Millettia root for content of rotenon or other extractable poisons.—*Translator.*

and fruit in hot-houses Derris emulsion has proved to be an excellent means of killing plant lice; wool lice, however, owing to their natural protective covering, escaped. Flies and fly larvae proved to be immune. At the Veterinary School, dipping of cattle proved to be very effective; ticks especially were completely killed by the emulsion.

The justified demand for a more handy form of the material than the bulky bales of dried roots first led to practical means of reducing the volume and experiments were made in grinding it. A large quantity of roots was ground coarsely, part thereof was ground more finely and part of that still more finely again. Samples of the three powders were sent to the Commercial Museum for examination—(H.M.W. 1266—1.2 & 3).

The moisture content and the toxic principles were determined in the usual way and the averages of analyses in duplicate were found to be:

| SAMPLE. | Moisture percentage. | Ether Extract. | |
|---|---|---|---|
| | | Percentage of air dried material. | Percentage of dry substance. |
| I. Ground once. coarse ... | 9.1 | 11.1 | 12.2 |
| II. „ twice. finer ... | 8.4 | 11.7 | 12.8 |
| III. „ thrice. very fine... | 8.5 | 12.05 | 13.2 |

The figures in the last column increase steadily and this proves that the finer the material is ground, the more "derrid" is found on analysis. That, however, does not mean that in practice the very finely ground condition of sample No. 3 would be preferable to the more coarsely ground condition of sample No. 1. It might very well be found that sample No. 1 in practice surrenders its toxic ingredients more easily or forms a more efficacious emulsion than the very fine powder of sample No. 3 which may have a tendency to cake. Something similar happens with other materials, for instance, those containing essential oils; that is, the material to be worked must not be too fine.

The three samples of different fineness have been subjected to a series of extraction tests. The first series of tests was made as follows:—

A weighed quantity of each sample with six times its weight of water was shaken in a shaking apparatus for 1½ hours (The Deli Experiment Station grinds the same proportion of root and water for ½ hour in a mill). After shaking, the "porridge" was filtered through muslin, squeezed and then pressed. The still moist powder was then rubbed loose again and dried in a desiccator for two days, after which its toxic content—which for brevity's sake will be called "derrid"—was determined. Deduction of this figure from the already known derrid percentage of the original root powder gives the percentage extracted by the water.

*Sample I.* 20 grams of powder. Derrid percentage 11.1. After extraction with

water and drying of the residue 17.1 grams of powder was left, the derrid percentage of which was 5.72. Thus, nearly 56 per cent. was extracted.
*Sample II.* 15 grams of powder. Derrid percentage 11.7. Dry residue 13.9 grams of powder with 5.5 per cent. of derrid. This also amounts to 56 per cent. of extraction.
*Sample III.* 15 grams of powder. Derrid percentage 12.05. Dry residue 12.58 grams of powder with 6.79 per cent. of derrid. This amounts to 52 per cent. of extraction.

This show that the fineness of grinding has not affected the quantity of derrid extracted. Of the toxic ingredients half only was extracted. It may be that the method of the Deli Experiment Station, in which the root is ground between two millstones, is more efficacious than the shaking in a shaking apparatus.

We have for that reason made further tests with samples Nos. 2 and 3. Of sample No. 1 nothing was left.

The powder was rubbed in a mortar with water, spread on muslin folded four times, and then squeezed out. The treatment was repeated four times with further additions of water. More water had to be used than in the first series of tests as otherwise the powder would not have been wet enough to be squeezed out. Finally, the residue was tightly squeezed and dried and its derrid percentage determined as in the first series of tests.
*Sample II.* 20 grams of powder. Derrid percentage 11.7. Rubbed 5 times with 50 c.c. of water. Dry residue 17.1 grams of powder with 2.3 per cent. of derrid. This works out at 80 per cent. extraction.
*Sample III.* 20 grams of powder. Derrid percentage 12.05. Rubbed 5 times with 50 c.c. of water. Dry residue 17.1 grams of powder with 2.3 per cent. of derrid. This works out at 82 per cent. extraction.
Here too the fineness of grinding does not affect the quantity of derrid extracted; but the rubbing method extracted a far greater percentage than the shaking method.

Grinding the root in the country of origin and shipping the powder in pressed bales may meet the requirements of the wholesale trade; the retail trade and the consumer will, however, want it in a more quickly applicable form.

In Deli, Sumatra, a concentrated emulsion that only needs dilution before use is made from the roots. This concentrated emulsion keeps better than might be expected, but eventually its strength deteriorates.

In Japan a preparation is made by dissolving the active ingredients of derris roots in a certain oil; the process has been patented. Derris in this form is said to be very efficient; scientific reports of results obtained are, however, still lacking.

# THE DEVELOPMENT OF IMPROVED LIVE STOCK IN THE TROPICS.*

Progress towards the improvement of live stock in tropical countries has been slow. Too great a reliance has been placed on stock imported from temperate countries. The importation of stock into the Philippines from temperate climates has met with meagre success. When the breeds are from tropical countries such as India and China they have proved more successful.

For many years poultry of many of the well-known breeds were imported from the United States of America and Australia. None of these breeds were able to adapt themselves to the Philppine conditions.

In 1914 native yellow fowls were imported from Canton. These chickens were very small and they laid only a few small eggs. A definite body type, however, was noticed. Possibilities in these chickens were very apparent; they allowed themselves to be confined, they were hardy and they were adapted to local conditions, tending to improve under conditions where the other imported chickens degenerated. Years of strict selection and culling, combined with careful mating, good housing and excellent feeding have produced a strain now styled the "Los Banos Improved Cantonese" chickens. They are larger than the original Cantonese. The colour of feather is uniformly rich golden buff, with yellow skin. The eggs are light brown in colour, fairly large in size and satisfactory in number, being about 120 a year. The highest number recorded was from one bird that laid 237 eggs in 365 days.

The experience with other live stock has been similar to that of poultry. The Philippine Government has repeatedly imported improved breeds of horses, dairy cattle, beef cattle and swine from the temperate countries, but they have been unsuccessful; whereas animals imported from India, such as buffaloes and Nellore cattle have done very well. Goats and sheep introduced from India appear perfectly at home in the Islands, unlike these that have been imported from temperate countries which did not do well; even their grades with the native stock failed. A Philippine authority has summed up the position in the following words:—"the ultimate solution of the live stock problems of the Philippines will depend in large measure on the development of superior breeds particularly adapted to the country through gametic methods borrowing physical merits from the breeds of temperate countries and judicially forming mosaics with the hardy characteristics existing in Oriental animals."

Studies towards the improvement of Philippine swine furnish an excellent illustration of the use of temperate animals to develop a tropical breed. Of imported breeds, only the Berkshire and Duroc Jersey did fairly well in the Philippines. Grading with the Duroc Jersey was a failure, while grading with

* Abstract of an article by F. M. Fronda, Assistant Professor of Poultry Husbandry, University of the Philippines and published in *Lingnan Science Journal,* Vol. 9, No. 3, October, 1930.

the Berkshire, though accompanied by great difficulties because of death caused by kidney worms especially, low vitality and low fertility, has left enough individuals that have stood all the tests of the environment.

A large strain of native swine, known as the Jala-jala was used to impart resistance to disease. With the Berkshire-Jala-jala mating, the foundation of the Berk-Jala swine was formed. In this work it was observed that the greater the proportions of Berkshire blood in the progeny beyond $\frac{5}{8}$, the less satisfactory the results. Pigs carrying $\frac{5}{8}$ Berkshire blood gave the best results and at the same time were of the right proportions.

Investigations with cattle have given similar results. Hereford cattle were imported. The progeny of these animals were very delicate and a large proportion of them died young. Those that survived grew very well for the first few months, then became stationary in weight.

However, 50 per cent. grades with either native or Indian cows are found to grow normally and are almost as hardy as the dams, although they do not stand neglect as well as native cattle. Three-quarter grades are very delicate, being almost like pure breeds in this characteristic. The results of later matings show fairly conclusively that if efforts are made to fix a definite breed from the Hereford native cattle, the progeny carrying about $\frac{1}{2}$ Hereford blood will have to be utilised.

There is little data regarding horse breeding. The Arabian, on the whole, has been the most successful imported breed. Grade Arabian-Filipino horses may now be found in certain regions and quite a number are being used on the race tracks in Manila. What proportion of the Arabian blood with the native horse will produce the best results is still an open question.

Regarding dairy cattle, the Philippine experience has been that imported stock deteriorate rapidly so that new importations are constantly required to maintain the milk supply.

Experiments with goats proved similar to those with cattle, a 50 per cent. mixture giving the best results.

The conclusion is drawn that "with China's rich supply of unimproved domestic animals and with her many and varied conditions favourable for their development, the possibilities of live stock improvement in this country (China) are great. The proximity of the Philippines to this country, the similarity of environmental conditions in both places and the common qualities of our native domestic animals are an insurance that what experience we have had in the improvement of live stock may be profitably used as a guide for similar undertakings in this country."

## RUBBER ROADWAYS.*

The failure of the first experiments in rubber paving was due to the fact that the blocks "crept," the traffic pushing them in the direction of travel, the joints between the blocks were broken allowing water to get to the foundations.

Progress since these early experiments has been both rapid and definite. Demonstration sections have been laid which have successfully withstood the strain in streets where the heaviest and most varied modern traffic can be found; no movement has been observed, and no joint has been broken after several years.

Furthermore, rubber paving can be produced and laid at a price which makes it possible for the road engineer to lay it in streets and areas where silence and absence of vibration justify the higher (but not materially higher) initial cost.

Rubber paving obviates the two great evils of modern traffic, noise and vibration. No other material possesses these remarkable properties. Further, a rubber road makes no dust and is not slippery.

Although he can now obtain rubber paving at a reasonable price, the city engineer cannot state yet what will be the ultimate life of a good and sound rubber block. This difficulty is being overcome by an adequate free maintenance guarantee by the contractor.

A scheme put up by the Rubber Growers' Association Council to their members and to Dutch and Asiatic producers, provides for a supply of free rubber to approved manufacturers of rubber paving to facilitate research and to assist during the period of commercial introduction; but more important still, it would guarantee manufacturers and municipal bodies for a period of five years against a substantial rise in the price of the raw material. The approved manufacturers would be guaranteed supplies of raw rubber up to a certain percentage of the crop of the Rubber Growers' Association members and of other producers who come in, at 6d. per pound or market price, whichever is the lower, and a further percentage at 9d. per pound or market price, whichever is the lower. This would enable the manufacturer to maintain his price at a low figure irrespective of fluctuations in price of raw rubber.

The writer concludes that the scheme would be of permanent assistance to the rubber industry and that the manufacturers would not be allowed to suffer should the price of the raw material at the end of five years be such as to make further arrangements with the producers necessary.

Municipalities which embark on a definite programme of rubber paving to be carried out over a period of several years could therefore rely on prices not going up in the midst of the execution of their programme.

* Abstracted from "Noiseless, Dustless Highways," published in *The Commercial* of November 27th, 1930.

# Reviews.

## The Soya Bean and the New Soya Flour.

BY

C. J. FERREE.

*William Heineman (Medical Books) Ltd., London,* 1929.

This translation forms a useful and concise compilation of information regarding trade statistics and the food value of the soya bean.

This bean can be grown easily under a very wide range of conditions, forms a profitable rotation crop with maize, wheat and other cereals, and its cost of production is comparatively low in countries where it is grown on a large scale. Production has been greatly stimulated, chiefly in Manchuria, during the past few years, without however affecting the price of the product materially, though its extended use has been a factor in depressing the price of other oil producing products (copra, etc.)

The high *food value* of the soya bean is stressed and confirmed by chemical and medical opinion, and the extended use of the bean in a European diet is advocated, especially in the form of flour as an admixture with wheaten flour in the staple diet. The strong flavour of the boiled beans is not palatable to most Europeans, but, used as flour and mixed with other foods in varying proportions (numerous recipes are given), the taste is counter-balanced and the food ration is rendered more nutritious.

The book extols the use of the Berezeller's soya flour, but unfortunately, does not mention its price or where it is obtainable, and it does not appear to be known by local chemists or grocers.

H. W. J.

## Elucidative Notes on the "Kapok Decree." *

BY

DR. W. L. UTERMARK.

*Pamphlet No. 53 of the Division Commercial Museum of the Royal Society Colonial Institute of the Netherlands at Amsterdam.*

In this pamphlet the author gives the history and object of a recent Decree of the Government of the Netherlands by which the sale of any adulterated kapok or of any article in the manufacture of which adulterated kapok has been used, is made a heavily punishable offence unless duly and properly marked as having been adulterated with other fibres and to what extent.

As "kapok" the Decree defines:

"the fibre taken from the inside of the fruit of *Ceiba pentandra* Gaertner

* Het Kapokbesluit Toegelicht.

and of species of the genus Bombax and not containing more than traces of impurities."

The Decree owes its enactment to a petition, presented to the Ministry of Labour, Industry and Commerce by the Association of Wholesale Kapok Merchants and the Association of Dutch Kapok Manufacturers with the collaboration of the Commercial Museum.

The object of the Decree is to put a stop to the abusive practice of selling in retail, as genuine kapok, for the sake of cheapness, articles filled with adulterated kapok or the adulterated filling material itself for the home-manufacture of such articles.

Adulteration, however slight, is all the more reprehensible because even a small admixture of foreign material reduces the efficacy of the kapok itself out of all proportion to the percentage of the admixture.

The Netherlands rank as the greatest per capita consumer of kapok and the interests of the manufacturers of bedding, life-saving apparatus, etc. demanded protection from the danger involved in loss of public confidence in the quality and efficiacy of their own products as a result of the inevitable dissatisfaction that the use of cheap substitutes, manufactured by irresponsible persons and sold under the name of the genuine article, is bound to engender. It was feared that otherwise in the long run the genuine article itself would become generally discredited with detrimental effect on the demand.

Java kapok is of a superior quality and Java supplies to the Netherlands about 70 per cent. of the total yearly import of about 5400 tons. Java's total export in 1928 and 1929 was respectively 18,360 and 17,667 tons of a value of respectively about £1,625,000 and £1,560,000. It was, therefore, considered all the more necessary to protect the fair name of the Java kapok.

The most common adulterations are cotton, plant silk, Bombay "akund" and waste of artificial silk. The latter three are easily detected under the microscope; cotton less easily. In preparations with water or a mixture of water and glycerine admixture of a weakly acid per cent. solution of anilinsulphate will, however, stain the kapok fibre yellow whereas the cotton fibre remains unaffected. Fuchsin solution (1 gram to 6000 c.c. of 50 per cent. alcohol) stains the kapok fibre a bright red—less bright when unripe—whereas the cotton fibre is very little affected. A further means of detection of admixture of foreign material is the pentosan determination, directions for which are given. Pure kapok, dried at 102°—105°C, contains at least 25 per cent. pentosan whereas cotton contains 3 per cent. only. Bombay "akund" has so high a pentosan percentage that a mixture of kapok, cotton and akund in the proper proportions will give the normal pentosan percentage of pure kapok. But akund, as stated before, is easily detected under the miscroscope and its presence is even visible to the unaided trained eye.

That the legislator means business is proved by the fact that the penalty for offences against this Decree is imprisonment of up to six months or a fine of up to Grs. 2000—(£166.13.4)—and confiscation of the merchandise involved.

The pamphlet further contains a reprint of an earlier pamphlet, giving

botanical and economic particulars, directions for curing and packing and an enumeration of the properties and uses of kapok.

L. A. J. R.

## Report on the Cultivation, Treatment and Prospects of Rice in British Guiana.

BY

CHARLES E. DOUGLAS, M.I.Mech.E., A.M.I.Pet.T., M.I.Struct.E.

*Issued by the Empire Marketing Board, August,* 1930.
*Printed and Published by His Majesty's Stationery Office, London.*
*Price 1s. 0d. Net.*

The author opens by a general description of rice growing conditions pointing out that the country is admirably suited for rice since the cultivated lands are flat, the soil is good (mostly old sugar land) and there is an abundant water supply.

The rice is grown either on sugar estates by and for the coolies employed thereon or by small farmers for profit, or by large estates as the main crop, or in conjunction with bananas or coconuts, chiefly for export.

It is of interest to note that the fields are ploughed by oxen and are mainly planted with seedlings which are only 4 weeks old whereas in Malaya the optimum age of seedlings is usually taken as 6 weeks. On large plantations, cultivation and irrigation are carefully tended whereas small tenant farms show much neglect in these particulars and need some form of supervision.

The area cultivated in 1929 was 59,000 acres which produced 71,000 tons of padi or 42,600 tons of rice of which 14,000 tons were exported as parboiled rice. The author mentions that the market for this type of rice is restricted to areas where East Indian labour is found and that the demand for such rice is easily met from the cheaper Eastern markets and, therefore, infers that British Guiana parboiled rice can only enjoy a very limited market.

On the other hand, there is an immense market for white rice of good quality and the Colony should aim at the capture of a large share of this trade in neighbouring countries.

In most of the rice lands mechanical cultivation is hardly possible under existing conditions, because of the smallness of the fields, but this defect can be remedied and there is ample evidence that mechanical methods are practicable in the Colony if due consideration is given to the type and weight of the machinery used, the time and circumstances of their use and adequate cleaning and housing after use, although the question of capital cost will debar many tenant farmers from progress in this direction.

As far as marketing of British Guiana rice is concerned, there has been practically no organisation so that the product is sold in small quantities of varying quality indifferently bagged and therefore is not held in good repute by the large traders.

The adoption and enforcement of uniform standards in quality, bagging, shipping and selling should help materially in establishing the reputation of the product especially if such measures are combined with agricultural research directed at the improvement of grain types towards securing the local markets and of methods of cultivation and milling.

Several illustrations and diagrams are included, the most useful being those of types of small mills and the tables of costs of production of rice in the Colony. The latter are informative and compare closely with those in Malaya if the Straits Dollar is substituted for the American.

H. W. J.

## The Bionomics and Control of *Leptocorisa acuta* Thunb. with Notes on Other Leptocorisa spp. in Malaya

BY

C. H. Corbett, B. Sc.

*Special Bulletin, Scientific Series No. 4 Department of Agriculture, S.S. and F.M.S. 39 pp. 7 plates: price $1 (Straits Settlements currency) F.M.S. Government Printing Office, Kuala Lumpur, 1930.*

On the five species of the genus *Leptocorisa* occurring in Malaya *Leptocorisa acuta* Thunb, is considered to be the most series pest of padi in certain districts. In some cases, the yield of padi has been reduced by 30 per cent. of the normal by reason of its attacks.

These bugs occasion damage by sucking the sap from the developing grain in consequence of which no grain is formed.

The insects attack grasses as well as padi, a fact which enables them to tide over the period when no padi is on the fields. Furthermore, in a normal year a resting period would appear to occur during the drier months, at the termination of which the insects swarm to grasses and then to the first flowering padi.

Part II and III of this Bulletin deal with the systematic and biological work on Malayan species of *Leptocorisa*, while Part IV is concerned with methods for the control of the pest. These methods of control may be summed up as follows:—(a) Uniform planting throughout large areas, (b) systematic trapping to small areas of grasses or early maturing padi and (c) collection of the pest on padi by means of "wands." The result of the practical application of the methods is described. The author urges that "without active organised campaign this insect will continue to cause heavy losses, but if they are undertaken control is assured, with the result that yields of padi will not be greatly reduced through the agency of this insect."

D. H. G.

## Miscellaneous.

# DISTRIBUTION OF *OIDIUM HEVEAE* DISEASE OF RUBBER IN MALACCA AND SOUTHERN NEGRI SEMBILAN, NOVEMBER, 1930.

BY

F. Beeley, B.Sc. (Leeds.)

*Field Officer, Rubber Research Institute of Malaya.*

From Kuala Lumpur the direct route to Malacca via Seremban and Tampin was taken. From Malacca various radial roads were taken with the particular object of examining estates and small holdings in the South Eastern half of Malacca Territory. The return journey was via Batang Malaka, Tampin, Bahau, Kuala Pilah and Seremban.

To determine the presence or absence of the disease, young leaves and flowers developed on new shoots produced during recent wet weather were examined with a hand lens, and of specimens showing the presence of the fungus a few were preserved in Piero Formal solution and brought back to the laboratory for confirmation by microscopical examination. These latter in each case amply confirmed notes made on the spot. It was again noted that mature leaves showed no signs of the living fungus, though many leaves shewed the effects of an attack by the fungus during their early stages of growth. The active fungus could usually be found on young leaves up to 2 or 3 inches in length, and the underside of such leaves showed grey furry patches of fungus when viewed from a very oblique angle.

Districts of known infection—

| *District.* | *Service Road.* |
|---|---|
| Ayer Panas and Ayer Molek ... | Malacca-Jasin. |
| Jasin and Merlimau ... ... | Jasin-Merlimau. |
| Chin Chin ... ... ... | Jasin-Tangkak. |
| Rim, Nyalas and Chalau ... | Jasin-Bukit Asahan. |
| Kesang, Selander and Batang Malaka | Jasin-Batang Malaka. |
| Tampin—slight infection only ... | |
| Gemencheh ... ... ... | Batang Malaka-Gemencheh. |
| Jeram Padang ... ... ... | Tampin-Bahau. |

The "Johol" district of Negri Sembilan, from which reports of the presence of the disease were received earlier in the year, appeared to have made a complete recovery from the disease. Similarly, the younger rubber in the Gadek, Pegoh and Tampin districts had made good recovery, while the older rubber over 15 years still showed effects of the disease, though presence of the fungus could not be demonstrated during the visit.

MAP OF TOUR OF MALACCA
AND
NEGRI SEMBILAN
Nov. 10-14, 1930
Bahau
K.Dilah
SEREMBAN
NEGRI SEMBILAN
Johol
Gemas
Gemencheh
Tampin
Batang Malaka
Asahan
Mt. Ophir
MALACCA
Jasin
Tangkak
JOHORE
MALACCA
MUAR
Roads Travelled
Mildew Present
Slight Mildew

The active sporulating fungus could be found only on the young leaves and flowers produced during the recent growing weather. In some cases the fungus was having very little effect on the leaves, but in others, more especially on older rubber trees, the young leaves were beginning to discolour preparatory to falling off. No extensive leaf fall was actually taking place, save on a few occasional branches of trees which has wintered prematurely. The younger rubber trees seemed to be least affected and to have made the best recovery from the April attack.

Trees under 3 years old failed to show the presence of the fungus and the mature leaves failed to show possible effects of an attack by the Mildew fungus. The foliage of 2 and 3 years old clearings, even though surrounded by known affected fields of older rubber, bore an excellent crown of foliage.

Trees over 15 years seemed to carry the heaviest infection of the fungus at the present time, while the recovery from the April attack was very poor. The foliage in such fields of old rubber was in most districts very light, consisting of pale, mottled green wrinkled and often undersized leaves.

Very few maturing seeds were observed, indicating that flowers must have been infected practically throughout the year.

From these observations it would appear that the greatest necessity for treatment obtains in areas of rubber over about 15 years old.

Young leaves in such areas were observed to be heavily infected and should dry weather occur during the next wintering and re-foliation period, a heavy fall of young leaves during re-foliation may be expected.

The Director, Rubber Research Institute of Malaya, in a letter which accompanied this report stated—

> "As will be seen from this report, the fungus has persisted in some areas since the original heavy attack earlier this year" (1930.)
>
> "It is proposed early next year, shortly before the wintering season, to carry out preventive spraying on a considerable area, in order to ascertain whether such measures are likely to prove effective. This can, of course, only be proved definitely if an outbreak happens to occur after the wintering season. I consider, however, that such work is essential. An Agency firm has been good enough to place at our disposal suitable areas in the affected districts."

---

Mr. Bjorklund, the inventor of the Duster of that name for the treatment of Oidium disease has recently arrived in Malaya. He will be pleased to arrange for demonstrations of his Duster as time permits. Applications for demonstrations should be addressed to his Agents, Messrs. Diethelm & Co., Ltd., Singapore.

## THE AGRICULTURAL ADVISORY COMMITTEE.

The Agricultural Advisory Committee met at the Department of Agriculture, Kuala Lumpur, on January 15th, 1931, under the Chairmanship of the Director of Agriculture, Dr. H. A. Tempany. The following are among the more important subjects considered by the Committee.

*Extension of Work to the Unfederated Malay States.* Progress has been made in this direction. Two European Officers have been seconded, one to the service of Kedah and the other to Kelantan. It is hoped, in due course, to extend the agricultural services to the other Unfederated Malay States.

*Seed Distribution in Krian.* Distribution of pedigree seed in the padi growing district of Krian has proved moderately successful during the past season. Although less seed was sold than was anticipated, nevertheless, 5451 gantangs of seed were disposed of at a loss to Government of $405. Members of the local co-operative societies were amongst the best patrons for this seed. Next year it is hoped to extend distribution of seed in Malacca from pure lines grown at the Pulau Gadong Station, Malacca.

It was suggested that organised visits of Co-operative Societies to the Rice Experiment Station, Pulau Gadong, Malacca, will be the only effective method of insuring distribution of pedigree seed. It has also been suggested that visits of local headmen from the State of Pahang to Malacca and Negri Sembilan instead of Krian where the conditions are highly specialised would prove useful in this connection.

*Parasite Control Work.* The Chairman stated that the work of the Entomological Division on parasite control is one of the most important items on the programme of the Department. It has been found that stem borer damage to padi in Krian is greater than was anticipated. The work will be repeated next year when an endeavour will be made to ascertain the number of parasites necessary for the control of large areas and the probable cost of extending the work throughout Malaya. An officer will be sent to Kedah to ascertain whether the stem borer pest is as serious there as it is in Krian.

*Standard Manurial Experiments.* Modern work has resulted in certain definite requirements being laid down which all manurial experiments must fulfill. A Committee controls and co-ordinates the work of this nature in the Department of Agriculture. This Committee has laid down standard manurial experiments on padi which are at present being conducted at the Pulau Gadong, Talang and Titi Serong experimental stations.

*Coconuts.* In the course of several items on the coconut industry which were discussed by the Committee, the Chairman stated that the possibility of erecting standards for copra, especially among small-holders is being considered by a small Committee as also is Government inspection and grading, such as is practised in West Africa and certain other countries. It is admitted that there is at present no incentive for small-holders to improve their copra, but this needs further investigation.

*Film Propaganda.* The Chairman reported that the Propaganda Van has been completed and has made a few preliminary trials. The first lecture tour will start on 19th. January. The trailer is not yet completed. When completed, exhibits of specimens will be placed on the trailer.

A film is in course of preparation by the Department which is designed to drive home the importance of extending the cultivation of padi and also of using pedigree seed.

*Palm Kernel Oil.* Attention was drawn to the report on the low quality of Malayan palm oil. Following suggestions made by Major Eaton, an enquiry was addressed to Sumatra from which it transpired that Sumatran palm oil is sold at lower prices than that from West Africa. This is attributed to factory methods employed in extracting the kernel. Further comparisons of African and Malayan kernels will be made.

The question of rat damage on oil palm estates was discussed. It is stated that such damage is increasing. The Department has recently been in correspondence with the Pasteur Institute in Paris with regard to their latest virus, but the replies received were unsatisfactory.

It is considered that control of rats is a matter for an organised simultaneous campaign of estates. The Department cannot undertake such a campaign, but officers could be detailed to assist and advise.

*Work at Cameron's Highlands.* Government has definitely decided that the Department shall retain the Tanah Rata experimental station.

Mr. Curtler, Assistant Agriculturist, is to be stationed at Cameron's Highlands not only to look after the Experimental Station, but also to give advice to the planting community on general agricultural questions and to Government on the question of alienation of land.

*Establishment of a Dairy at Fraser's Hill.* Arrangements for the establishment of such a dairy are well advanced. Mr. Ritchings, Horticultural Assistant, will shortly be stationed on the Hill and it is proposed to establish a farm in connection with the dairy from which it is hoped eventually to supply fresh vegetables to other parts of Malaya.

*School of Agriculture, Malaya.* The buildings are practically completed and furniture is in process of installation. There are at present about 30 applications for the three year's course and 400 for the short course. The total accommodation is 80.

*School Gardens.* The representative of the Education Department expressed appreciation of the work of the Department of Agriculture in connection with school garden work. It is agreed that consideration should be given to a "Gardens Week," that is, a competition for village gardens. It was agreed that the teaching of gardening in elementary schools is essential if a true agricultural sense is to be developed in Malaya.

# Departmental.

## FROM THE DISTRICTS.

### The Weather.

In the northern Districts of Kedah dry weather was experienced throughout the month, but in most parts of the Peninsula heavy rain in the first half of the month was succeeded by fine dry weather towards its close. In parts of Pahang there were severe floods, notably at Temerloh and Pekan where the water did not subside until about two weeks had elapsd.

### Remark on Crops.

*Rubber.*—The local prices given for rubber from small holdings weakened slightly, smoked sheet selling for $12 to $17 a picul and unsmoked sheet for $9 to $14 a picul.

Wintering had commenced in Seremban and Port Dickson Districts of the Negri Sembilan by the end of the month. In Pahang West wet weather and the continued low price combined to cause a further increase in the number of untapped holdings.

Mouldy Rot disease remained in evidence and required continuous careful attention, notably in parts of Perak South and Selangor where special measures have been found necessary to ensure its effective control.

*Padi.*—Reaping was in progress throughout the country, except in Perak North where the crop has not yet ripened. In most of the padi areas along the Pahang river a satisfactory crop was reaped before the floods commenced, except in the parts of Pekan District nearer the mouth of the river where it is feared that most of the padi was destroyed.

In general, yields are expected to be quite up to the average, while the crops in Kedah and Province Wellesley are reported to be distinctly good. Unfortunately, the price remained very low owing to the effect of big crops and low prices in Burma and other rice exporting countries.

An endeavour is being made in Kedah to carry out a scheme for checking estimated yields by cutting and measuring the crops from a number of small plots, each 1/45 acre, taken at random. The results are being compared with the estimates of the crop supplied by the growers themselves. So far the figures obtained by the two methods have been found to agree fairly closely.

*Sogata furcifera (pallescens)* caused but little further damage to padi in Krian District. In the Central District of Malacca counts of the number of padi stems attacked by the various stem borers indicated that these pests must be causing considerable loss, since the records available up to the end of the month showed that slightly more than 50 per cent. of the stems were bored.

*Coconuts.*—In some of the inland Districts, especially in the Negri Sembilan and Selangor, the price of nuts has risen by one or two cents each in response to

the extra demand from Malays during the fasting month. In the Negri Sembilan, there has also been a rise in the price of other products consumed by Malays during this period, as for example cooking bananas, locally made palm sugar and fish.

Outbreaks of the nettle caterpillar *(Setora nitens)* were recorded on two estates in Perak South. Another outbreak near Alor Star in Kedah was quickly controlled by a Tachinid parasite.

*Fruit.*—There was a good crop of fruit in Perak South particularly of durians and rambutans. In Selangor the crop was fair except in the Districts of Ulu Langat and Kuala Langat where it was below average. Durian, mangosteen, rambutan, pulasan and langsat were available in the markets. In the Negri Semblian there was a fair crop of durian, langsat and mangosteen, but the crop of other fruits such as rambutan, chiku and rambai was small. In Pahang West all these fruits were harvested in fair quantity.

*Food Crops.*—In Pahang West the recent flooding of the Pahang river and its main tributaries resulted in the inundation of considerable areas planted with food crops such as maize and tapioca. The crops are said to have been lost in many cases, but details of the extent of the damage are not yet available.

*Coffee.*—Good crops were reported to have been obtained in Selangor, but the market price remained low, being 12—20 cents a kati for beans in Selangor and $20—$22 a picul in Pahang West.

The Agricultural Field Officer, Negri Sembilan, gives the following instance of the success of measures for the control of the Coffee Berry Borer *(Cryphallus hampei)*. In 1930 a property in Kuala Pilah District was found to be badly infested and in accordance with departmental recommendations the trees were stripped of all fruit. On inspection of the area during January not a single infected berry was found though most of the trees were in bearing again and had a good crop of ripe fruit.

The incidence of this borer has decreased in most coffee properties in Pahang West.

*Tobacco.*—Certain Chinese market-gardeners in Province Wellesley have been growing tobacco for sale in Penang where it is made up into cheap cheroots. The price now offered, $25 per picul of leaf, is so low that the gardeners have decided temporarily to cease growing this crop.

The manager of an estate in Province Wellesley has become interested in tobacco cultivation and is preparing to plant a trial plot of 1 acre.

**Notes on Demonstration Stations and Padi Test Plots.**

*Telok Chengai Padi Experiment Station, Kedah.*—The growth of the padi was satisfactory. Work performed consisted mainly of daily examination of the plots for plants not true to type and of preparations for harvesting the early maturing varieties. Damage by stem borers (principally *Diatraea auricilea* and *Sesamia inferens)* was very noticeable in some of the plots.

*Kuala Kangsar Agricultural Station.*—The cover crop established in Decem-

ber made good growth. Preparations were made for replanting the vegetable area. Yams were harvested.

*Kuang and Kajang Padi Test Plots, Selangor.*—Harvesting was in progress throughout the month, being protracted owing to uneven ripening and wet weather. Much grain was lost through lodging and the depredations of sparrows. Allowing for the difficulties experienced a fair harvest should be obtained at Kuang, but at Kajang the crop as a whole is not expected to be satisfactory, though some of the more favourably situated plots looked promising.

*Dong Padi Test Plot, Pahang.*—Harvesting commenced on January 1st. in bad weather. Heavy rains during the ripening period are expected to result in a comparatively high percentage of empty ears and only a moderate crop is anticipated.

*Temerloh Padi Test Plot, Pahang.*—This plot was inundated for twelve days and the crop was destroyed, so that no results will be obtainable.

*Pulau Gadong Padi Experiment Station, Malacca.*—Harvesting was in progress throughout the month. A demonstration was given to over one hundred Malays who displayed considerable interest in some of the selected strains of local padi and most of whom took away bunches of ears for seed purposes.

*Sungei Udang Agricultural Station, Malacca.*—Good progress was made in clearing the land. The earth work of the entrance road was completed and the sites for the buildings were levelled.

### Plants Distributed.

In Pahang West planting material of tapioca, sorghum, groundnut, soya bean, and *Crotalaria usaramoensis* was distributed to school gardens. Distributions from the Seremban Fruit Nursery included seedlings of rambutan and annatto and cuttings of carpet grass, while marcots of rambutan and lime were obtained and distributed by the Agricultural Field Officer, Province Wellesley.

### Weekly Markets.

Weekly local markets in Kuala Pilah District of Negri Sembilan still continue to attract a large number of pepole. It was noticeable that the vegetable and fruit were mostly disposed of very quickly. The price of poultry in these markets is stated to be usually less than half that in the Kuala Pilah market, while the prices of vegetables in the latter market have been reduced.

### Rat Destruction.

In Province Wellesley 103,470 rat tails were collected during the month and 45,512 poisoned baits were distributed. In Krian 2,366 rats were destroyed, and very large quantities of poisoned baits were given out, since it was found that a certain amount of damage was being occasioned, in spite of the large number of rats killed during 1930. In Malacca rewards were paid for 21,763 tails and the position in respect of rat damage was satisfactory.

# DEPARTMENTAL NOTES.

## Visit of His Excellency to Serdang.

His Excellency the Officer Administering Government and High Commissioner of the Malay States, Mr. John Scott, C.M.G., visited the Government Experimental Plantation, Serdang, on 1st. December, 1930.

## Appointments.

Mr. G. E. Mann, M.C., M.A., Agricultural Instructor (Malay Officers), Department of Agriculture, S.S. & F.M.S., has been appointed Vice-Principal of the School of Agriculture, Malaya.

Mr. V. Dawson, B.SC., (McGill) has been appointed a Senior Lecturer, School of Agriculture, Malaya from 11th. December, 1930. Mr. Dawson assumed duty on his arrival in Malaya on 8th. January, 1931.

Mr. A. J. Simpson, B.SC., (Agric) has been appointed an Agricultural Field Officer, Department of Agriculture, S.S. & F.M.S. from 1st. January, 1931. Mr. Simpson will be stationed at Taiping for a short period of training in his duties. He will assume duty as Agricultural Field Officer, Perak South on the departure on leave of Mr. A. E. Curtler.

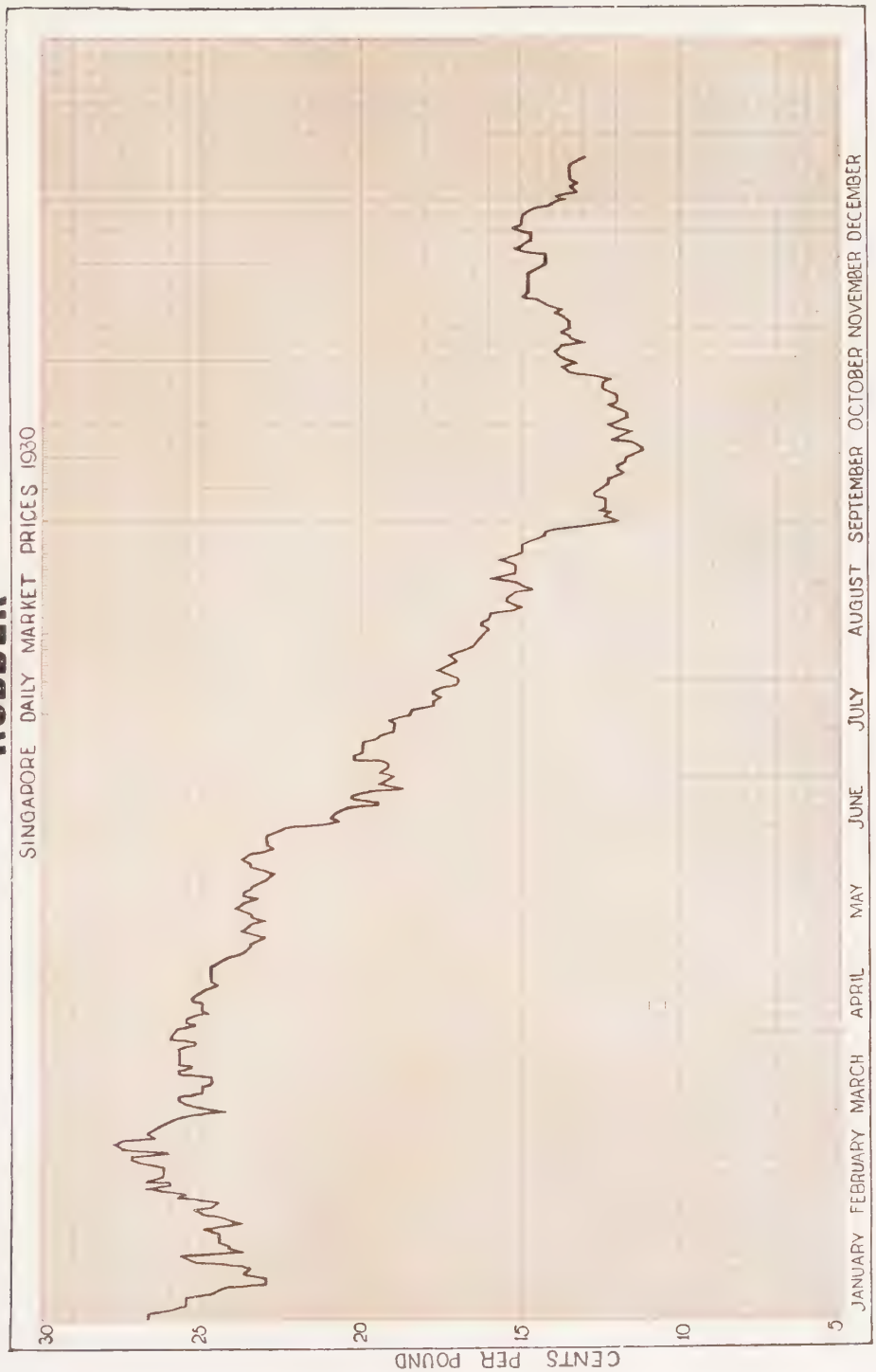
Mr. H. D. Leighton, C.D.A., has been appointed an Agricultural Field Officer, Department of Agriculture, S.S. & F.M.S. from 11th. December, 1930. He assumed duty on his arrival in Malaya on 8th. January, 1931. Mr. Leighton is stationed at Kuala Kangsar, Perak, as Agricultural Field Officer, Perak Central.

Mr. C. M. Maggs has been appointed an Horticultural Assistant, Department of Agriculture, S.S. & F.M.S. from 26th. December, 1930. Mr. Maggs assumed duty on his arrival in Malaya on 23rd. January, 1931.

## Leave.

Mr. A. Thompson, B.SC., Acting Mycologist, has been granted nine months and one day leave on full pay, with effect from the 6th. February, 1931.

Mr. J. M. Howlett, M.C., B.A., Cam. Dip. Agr., Agricultural Field Officer, Pahang East has been granted ten months leave on full pay, with effect from the 6th. February, 1931.


RUBBER
SINGAPORE DAILY MARKET PRICES 1930
CENTS PER POUND
30
25
20
15
10
5
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

# Statistical.

## MARKET PRICES.

### January, 1931.

*Rubber.*—The average price of rubber in Singapore was 12.8 cents per lb. against 14.3 cents per lb. in December 1930. The highest price quoted during the month was 13½ cents on 14th. January, the lowest being 11⅞ cents per lb. on 31st. The average London price for the month was 4.1d. against 4.3d. for the previous month. The highest price, 4¼d. was quoted on several dates, the lowest —3 15/16d.—on 31st. January.

*Palm Oil.*—No cabled quotations were received from London by our correspondent, which indicates that there is little change in the market. The quotations for the latter half of December were £16.10.0 to £16.12.6 f.o.b., basis 18 per cent. f.f.a. Other oils continued to decline, however, which may effect palm oil still further.

*Copra.*—The Singapore market has remained steady with a good demand. Supplies have been moderate. Average prices in Singapore: Sundried, $5.72; Mixed, $5.41; Cake, $1.75 per picul. The highest price for sundried was $5 :90 on 23rd; the lowest $5.50 on 5th. and 6th. Average prices in December 1930 were: Sundried, $6; Mixed $5.66; Cake, $1.75 per picul.

*Pineapples.*—Renewed activity in canned pineapples has been evinced during the month. There has been an improved demand and packers have tended to hold for higher prices. The "Winter Pack" is nearly finished and there is now a better consumption demand at slightly higher prices. 1½ lb. cubes advanced twenty cents to $3.60 per case; 1½ lb. sliced flat have advanced to $3.30; while 1½ lb. sliced tall have remained steady at $3.80 per case.

*Tapioca.*—Flake, fair has declined from $4.50 to $4.10 per picul; pearl, seed from $5.50 to $5.00 and pearl, medium from $6.25 to $6.00. Singapore average prices for January: flake, fair, $4.20; pearl, seed, $5.25; pearl, medium, $6.20 per picul, compared with $4.65; $5.71; $6.50 per picul in December. Prices for flake tapioca tended to harden towards the end of January.

*Sago.*—The Singapore market has been quiet with a moderate demand. Average prices: pearl, fair, $6.50; flour, Sarawak, $2.70 per picul. Corresponding averages for December were $6.50 and $3.04.

*Rice.*—Siam rice shewed an upward tendency, from $178 to $192; Saigon No. 1 was fairly steady between $175 and $180; Rangoon No. 1 declined during the first week of the month from $163 to a price around $155. Average prices in Singapore were Siam No. 2, $186, Saigon No. 1, 176, Rangoon No. 1, $156, all per coyan.

*Gambier.*—Supplies negligible and little business passing. Singapore average prices for January; block, $9.50; cube No. 1, $15 per picul.

*Pepper.*—Singapore prices sagged during the month, but closed steady on a firmer demand in London. Average prices: Singapore, black, $20.87; Singapore, white, $36; Muntok, white, $37.06 per picul. Average prices for the previous month were $22.62, $39, $40.50 respectively.

*Cloves.*—Average Singapore prices: Zanzibar, $62.25; Amboina, $60.25 per picul.

*Nutmegs.*—Featureless in Singapore market. Average prices for January; 110's, $23.88; 80's, $20 per picul, compared with $25.37 and $31.25 per picul in December 1930.

*Mace.*—Average prices in Singapore; Siouw $72.75; Amboina, $52.63 per picul against $73.50 and $50 respectively in December.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Market Reports published during January and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore), Ltd.

1 picul = 133⅓ lb; coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

# MALAYA RUBBER STATISTICS

STOCKS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORTS AND EXPORTS, AND THE ESTIMATED PRODUCTION OF ESTATES OF LESS THAN 100 ACRES, FOR THE MONTH OF DECEMBER, 1930, IN DRY TONS.

| Territory | Stocks at beginning of month | | | Production by Estates of 100 acres and over | | Production by Estates of less than 100 acres (estimated) | | Imports | | | | Exports (including re-exports) | | | | Stocks at end of month | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | during the month | | during the year 1930 | | during the month | | during the year 1930 | | | | |
| | Ports | Dealers | Estates of 100 acres and over | During the month | during the year 1930 | during the month | during the year 1930 | Foreign | From Malay States | Foreign | From Malay States | Foreign | Local | Foreign | Local | Dealers | Estates of 100 acres and over | Ports |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| MALAY STATES :— | | | | | | | | | | | | | | | | | | |
| Federated Malay States ... ... | ... | 11,536 | 15,764 | 13,445 | 140789 | 8,865 | 110206 | Nil | 3 | Nil | 69 | 15,474 | 6,476 | 182788 | 67,334 | 12,260 | 15,336 | ... |
| Johore ... ... | ... | 2,264 | 4,697 | 3,766 | 42,758 | 3,799 | 46,747 | Nil | 2 | Nil | 25 | 1,127 | 6,165 | 13,292 | 77,347 | 2,207 | 4,639 | ... |
| Kedah ... ... | ... | 511 | 2,266 | 2,468 | 24,210 | 1,159 | 14,392 | Nil | Nil | 30 | Nil | 1,080 | 2,375 | 9,669 | 28,634 | 435 | 2,614 | ... |
| Perlis ... ... | ... | 15 | 6 | 8 | 96 | 13 | 159 | Nil | Nil | Nil | Nil | Nil | 21 | Nil | 266 | 11 | 10 | ... |
| Kelantan ... | ... | 152 | 133 | 266 | 3,114 | 82 | 4,151 | 1 | Nil | 35 | Nil | 72 | 351 | 916 | 6,459 | 114 | 97 | ... |
| Trengganu* ... | .. | 55 | 50 | 80 | 1,333 | 39 | 664 | Nil | Nil | Nil | Nil | Nil | 119 | Nil | 1,998 | 55 | 50 | .. |
| STRAITS SETTLEMENTS | | | | | | | | | | | | | | | | | | |
| Malacca ... | ... | 3,166 | 1,908 | 1,439 | 14,827 | 6,136 | 38770 | Nil | 3,049 | Nil | 24,846 | 4,938 | Nil | 50,134 | Nil | 3,241 | 1,905 | ... |
| Province Wellesley | ... | 145 | 744 | 569 | 5,693 | | | | | | | | | | | 130 | 660 | ... |
| Dindings ... | ... | 140 | 112 | 100 | 1,175 | | | 707 | 3,593 | 8,461 | 40,189 | 6,418 | | 66,544 | | 233 | 119 | ... |
| Penang ... ... | 671 | 4,364 | 17 | 10 | 123 | | | | | | | | | | | 4,551 | 12 | 1,710 |
| Singapore ... | 3,345 | 29,056 | 321 | 190 | 2,657 | | | 7,314 | 8,860 | 100458 | 116909 | 16,390 | | 233799 | | 31,455 | 335 | 3,859 |

ANALYSIS OF COLONY, FEDERATED MALAY STATES AND JOHORE DEALERS' STOCKS AT END OF MONTH, IN DRY TONS.

| Class of Rubber | Federated Malay States | Singapore | Penang | Province Wellesley, Dindings and Malacca | Johore | Total |
|---|---|---|---|---|---|---|
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| Smoked sheet ... ... | 8,963 | 17,378 | 2,725 | 2,521 | 841 | 32,428 |
| Crepe ... ... ... | 583 | 10,389 | 1,164 | 687 | 196 | 13,019 |
| Unsmoked sheet ... | 1,477 | 3,688 | 662 | 396 | 644 | 8,630 |
| Scrap and lump ... | 1.237 | | | | 526 | |
| Total all Grades ... | 12,260 | 31,455 | 4,551 | 3,604 | 2,207 | 54,077 |

*Notes* :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less then 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, *i.e.* Column [7] = Columns [13] + [14] + [17] + [18] + [19] — [2] — [3] — [4] — [5] — [9] — [10]

3. Colony Dealers' Stocks are as published in Return I. & E 6, dated 10 January, [S. S. *Gazette* Not. No. 125], being dry weight as estimated by Dealers themselves.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios : Unsmoked Sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I & E. 5, dated January 3, [S. S. *Gazette* Not. No. 73]. foreign wet imports being reduced to dry weight by 25%.

6. Foreign Exports of each State and Settlement are those published in the Malaya Monthly Trade Return [Appendix II] and are distinct from Ocean-Shipments as published in Return I & E. 4, dated January 3, *Gazette* Not. No. 72 [Appendix IV to Monthly Trade Return].

7. Stocks and production in Trengganu are estimated from figures supplied by the Commisioner of Lands.

8. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore is always the most reliable.

10. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the columns comprising it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

J. I. MILLER, M.C S.
*Acting Registrar-General of Statistics, S S. and F M.S*

Singapore, January 19, 1931.

## Summary of Padi Reports, Federated Malay States, Straits Settlements, Kedah and Perlis for the month of December, 1930.

| State | District | Acreage of Padi Land | Planted Acreage | Percentage | Gross Crop | Crop per ac. 6 to 4 | REMARKS. |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | 4 to 3 | Gantangs | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| *Perak* | PERAK NORTH | | | | | | |
| | Krian ... ... ... | 53,250 | 49,060 | 92 | | | Bagan Serai five months planted: other places 1 to 3 months planted |
| | Larut ... ... ... | 8,525 | ... | | | | Planting almost completed. |
| | Selama ... ... ... | 3,450 | ... | | | | ,, completed. |
| | Kuala Kangsar ... ... | 13,997 | 13,797 | 99 | | | ,, ,, and flowering commenced in some mukims. |
| | Upper Perak ... ... | 3,739 | 3,739 | 100 | | | Four months planted. |
| | PERAK SOUTH | | | | | | |
| | Eight Mukims ... ... | 14,891 | 3,498 | 23 | | | Harvesting commenced in some mukims: others planting completed. Area of padi land revised. |
| | | 97,852 | | | | | |
| *Selangor* | Ulu Langat ... ... | 2,670 | 2,214 | 83 | | | Harvesting. |
| | Kuala Lumpur ... ... | 797 | 677 | 85 | | | ,, and grain setting. |
| | Ulu Selangor ... ... | 1,205 | 1,013 | 84 | | | ,, |
| | Kuala Selangor ... ... | 18,564 | ... | | | | ,, in Jeram: Other places transplanting completed. |
| | | 23,236 | | | | | |
| *Negri Sembilan* | Seremban ... ... | 4,904 | ... | | | | Ripening started and harvesting commenced in some places. |
| | Kuala Pilah ... ... | 17,931 | ... | | | | Flowering. |
| | Port Dickson ... ... | 159 | 152 | 96 | | | Fruiting. |
| | Jelebu ... ... | 3,116 | ... | | | | Harvesting. |
| | Tampin ... ... | 2,609 | 1,677 | 64 | | | Flowering. |
| | Rembau ... ... | 7,897 | 7,296 | 92 | | | do. |
| | | 36,616 | | | | | |

Summary of Padi Reports, Federated Malay States, Straits Settlements, Kedah and Perlis for the month of December, 1930.—(*Continued.*)

| State | District | Acreage of Padi Land | Acreage Planted | Percentage | Gross Crop | Crop per ac. 6 to 4 | REMARKS. |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | 4 to 3 | Gantangs | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| *Pahang* | PAHANG WEST | | | | | | |
| | Temerloh ... ... | 13,061 | 8,969 | 69 | | | Harvesting. |
| | Raub ... ... | 5,112 | ... | | | | ,, |
| | Kuala Lipis ... ... | 8,450 | 6,619 | 78 | | | ,, |
| | Bentong ... ... | 1,126 | 872 | 78 | | | ,, |
| | | 27,749 | | | | | |
| *Straits Settlements* | MALACCA | | | | | | |
| | Central ... ... | 15,723 | 14,861 | 95 | | | Harvesting about to commence. Planted area revised. |
| | Alor Gajah ... ... | 11,136 | 10,337 | 93 | | | Harvesting about to commence. Planted area revised. |
| | Jasin ... ... | 5,756 | 3,678 | 64 | | | Planted 3 months. |
| | | 32,615 | 28,876 | 88 | | | |
| | PROVINCE WELLESLEY | | | | | | |
| | North ... ... | 18,560 | 17,837 | 96 | | | Planted 3 to 5 months. |
| | Central ... ... | 10,539 | 10,316 | 98 | | | ,, 2 to 5 ,, |
| | South ... ... | 4,649 | 4,540 | 98 | | | ,, 1 to 3 ,, |
| | | 33,748 | 32,693 | 97 | | | |
| | DINDINGS ... ... | 450 | | | | | Planting completed. |
| | PENANG ... ... | 4,000 | 3,000 | 75 | | | Planted 2 to 5 months—Flowering commenced. |
| | SINGAPORE ... ... | Nil | | | | | |

## Summary of Padi Reports, Federated Malay States, Straits Settlements, Kedah and Perlis for the month of December, 1930.—(*Continued.*)

| State | District | Acreage of Padi Land | Acreage Planted | Percentage | Gross Crop | Crop per ac. 6 to 4 | REMARKS. |
|---|---|---|---|---|---|---|---|
| | | Acres | Acres | 4 to 3 | Gantangs | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| *Kedah* | Kota Star ... ... | 105,060 | | | | | Harvesting started on small scale. |
| | Langkawi ... ... | 4,908 | | | | | " " " " " |
| | Padang Terap ... ... | 6,637 | | | | | Planting nearly completed. |
| | Kubang Pasu ... ... | 35,094 | | | | | Harvesting started on small scale. |
| | Kuala Muda ... ... | 13,267 | | | | | " " " " " |
| | Baling and Sik ... ... | 19,156 | | | | | Planting almost completed. |
| | Kulim ... ... | 3,642 | | | | | Harvesting started on small scale. |
| | Bandar Bahru ... ... | 2,528 | | | | | Planting completed. |
| | Yen ... ... | 19,748 | | | | | " " |
| | | 210,040 | | | | | |
| *Perlis* | Western Area ... ... | 12,770 | 12,740 | 100 | | | Reaping will probably be finished by middle of February. |
| | Eastern Area ... ... | 8,820 | 8,540 | 97 | | | Reaping just begun will probably be finished in February. |
| | Southern Area ... ... | 16,890 | 14,470 | 86 | | | Kayang padi in ear. Rest reaping well in progress, should finish early in March. |
| | | 38,490 | 35,750 | 93 | | | |

*N.B.*—The figures given in the latest return under column 3 may be accepted as more accurate than any given in previous returns.

J. GORDON-CARRIE,

*Statistician.*

# METEOROLOGICAL SUMMARY, MALAYA. DECEMBER, 1930

| Locality | Air Temperature in degrees Fahrenheit | | | | | | | Earth Temperature | | Rainfall | | | | | | | | | Bright Sunshine | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Means of | | | Absolute Extremes | | | | | | Total | | Most in a day | Number of days | | | | | | Total | Daily Mean | Per cent | Length of Day |
| | A. Max. | B. Min. | Mean of A and B | Highest Max. | Lowest Min. | Lowest Max. | Highest Min. | At 1 foot | At 4 feet | | | Amt. | Precipitation* | Precipitation, 1mm. or more | Thunderstorm | Thunder heard | Fog morning obs. | Gale force 8 or more | | | | |
| | °F | °F | °F | °F | °F | °F | °F | °F | °F | in. | mm. | in. | | | | | | | hr. | hr. | % | hr. |
| Railway Hill, Kuala Lumpur, Selangor ... | 88.8 | 72.1 | 80.5 | 92 | 70 | 82 | 74 | 82.8 | 83.4 | 5.51 | 185.2 | 0.80 | 23 | 17 | 2 | 8 | 3 | | 126.25 | 4.07 | 34 | 11.9 |
| Bukit Jeram, Selangor ... | 87.3 | 73.0 | 80.1 | 91 | 71 | 81 | 75 | 83.7 | 85.3 | 11.30 | 287.0 | 4.88 | 20 | 14 | 3 | 11 | 1 | | 159.00 | 5.13 | 43 | 11.9 |
| Sitiawan, Perak ... | 87.6 | 72.6 | 80.1 | 91 | 70 | 82 | 74 | 83.2 | 84.0 | 9.76 | 247.9 | 1.84 | 19 | 15 | 7 | 11 | 1 | | 168.10 | 5.42 | ... | ... |
| Kroh, Perak ... | 85.3 | 69.8 | 77.5 | 89 | 65 | 79 | 73 | 78.7 | 80.7 | 8.16 | 207.3 | 1.90 | 25 | 20 | 3 | 8 | 6 | | 176.05 | 5.68 | ... | ... |
| Temerloh, Pahang ... | 86.1 | 72.8 | 79.5 | 90 | 71 | 77 | 75 | 82.6 | 84.4 | 7.05 | 179.1 | 1.97 | 22 | 17 | ... | 15 | 5 | | 116.00 | 3.74 | 31 | 11.9 |
| Kuala Lipis, Pahang ... | 86.5 | 71.6 | 79.1 | 91 | 70 | 74 | 73 | 82.1 | 82.9 | 15.43 | 391.9 | 3.84 | 26 | 22 | 8 | 10 | 17 | | 126.25 | 4.07 | ... | ... |
| Kuala Pahang, Pahang ... | 83.9 | 73.5 | 78.7 | 87 | 70 | 77 | 75 | 81.6 | 83.9 | 21.87 | 555.5 | 7.68 | 19 | 17 | 3 | 6 | 1 | | 166.50 | 5.37 | 45 | 12.0 |
| Cameron's Highlands, Rhodendron Hill, Pahang ... | 69.7 | 59.2 | 64.5 | 74 | 57 | 63 | 61 | ... | ... | 9.93 | 252.2 | 1.40 | 27 | 24 | ... | 7 | 1 | | 93.50 | 3.02 | 25 | 11.9 |
| Cameron's Higlands, Tanah Rata ... | 70.5 | 58.1 | 64.3 | 74 | 53 | 64 | 62 | 69.6 | 69.8 | 9.91 | 251.7 | 1.36 | 27 | 25 | ... | 13 | ... | | 92.40 | 2.98 | 25 | 11.9 |
| Fraser's Hill, Pahang ... | 71.2 | 61.3 | 66.3 | 76 | 60 | 64 | 63 | 70.0 | 71.0 | 12.72 | 323.1 | 1.39 | 29 | 25 | ... | 10 | 24 | | 77.60 | 2.50 | 21 | 11.9 |
| Mount Faber, Singapore ... | 88.4 | 73.6 | 80.0 | 91 | 71 | 80 | 77 | 80.1 | 81.8 | 7.39 | 187.7 | 1.30 | 23 | 16 | 1 | 14 | ... | | 141.80 | 4.57 | 38 | 12.1 |
| Butterworth, Province Wellesley ... | 86.5 | 73.7 | 80.1 | 90 | 70 | 81 | 75 | 83.0 | 83.7 | 7.60 | 193.1 | 2.40 | 19 | 16 | ... | 10 | 1 | | 201.25 | 6.49 | ... | ... |
| Bukit China, Malacca ... | 84.9 | 73.6 | 79.3 | 88 | 71 | 82 | 75 | 81.9 | 83.4 | 8.15 | 207.0 | 1.51 | 17 | 12 | 1 | 4 | ... | | 160.35 | 5.17 | 43 | 12.0 |
| Kluang, Johore ... | 85.6 | 72.3 | 78.9 | 90 | 70 | 79 | 74 | 81.0 | 81.8 | 7.29 | 185.2 | 1.14 | 22 | 17 | ... | 2 | 11 | | 126.25 | 4.07 | 34 | 12.0 |
| Bukit Lalang, Mersing, Johore | 84.1 | 72.5 | 78.3 | 93 | 70 | 76 | 75 | 80.3 | 81.1 | 19.57 | 497.1 | 4.20 | 24 | 20 | ... | 7 | 2 | | 136.75 | 4.41 | 37 | 12.0 |
| Alor Star, Kedah ... | 88.2 | 73.3 | 80.7 | 91 | 70 | 83 | 76 | 85.2 | 85.6 | 10.66 | 270.8 | 2.67 | 23 | 21 | 1 | 3 | 2 | | 202.40 | 6.53 | ... | ... |
| Kota Bharu, Kelantan ... | 84.5 | 73.3 | 78.9 | 88 | 71 | 79 | 76 | 81.6 | 82.9 | 19.77 | 502.2 | 6.25 | 23 | 17 | ... | 2 | ... | | 155.40 | 5.01 | ... | ... |
| Kuala Trengganu, Trengganu | 84.4 | 73.3 | 78.9 | 87 | 70 | 78 | 76 | 80.5 | 81.5 | 17.52 | 445.0 | 6.03 | 23 | 19 | ... | 3 | 2 | | 184.40 | 5.95 | ... | ... |

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.
Compiled from Returns supplied by the Meteorological Branch, Malaya.

# METEOROLOGICAL SUMMARY, MALAYA, FOR 1930

| Locality. | Air Temperature in degrees Fahrenheit | | | | | | | Earth Temperature | | Rainfall | | | | | | Bright Sunshine | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Means of | | | Means of Monthly Absolute Extremes | | | | | | Total | | Most in a day | | Number of days | | Total | Daily Mean |
| | A. Max. | B. Min. | Mean of A and B | Highest Max. | Lowest Min. | Lowest Max. | Highest Min. | At 1 foot | At 4 feet | | | Amount | Date | Precipitation, .01 in. or more | Precipitation, .04 in. or more | | |
| Railway Hill, Kuala Lumpur, Selangor ... | 91.3 | 72.1 | 81.7 | 95 | 69 | 85 | 74 | 83.6 | 84.0 | 82.80 | 2148.4 | 3.56 | May 2 | 188 | 147 | 2285.20 | 6.26 |
| Bukit Jeram, Selangor ... | 89.7 | 72.8 | 81.3 | 93 | 70 | 85 | 75 | 86.5 | 86.5 | 57.42 | 1458.6 | 4.88 | Dec. 9 | 165 | 127 | 2663.00 | 7.30 |
| Temerloh, Pahang ... | 90.0 | 72.3 | 81.2 | 94 | 69 | 82 | 75 | 84.7 | 85.7 | 76.80 | 1951.4 | 8.60 | Oct. 30 | 159 | 130 | 2322.95 | 6.36 |
| Kuala Lipis, Pahang ... | 88.9 | 71.6 | 80.3 | 92 | 69 | 82 | 74 | 83.5 | 83.5 | 97.35 | 2472.7 | 3.84 | Dec. 5 | 189 | 165 | 2245.60 | 6.15 |
| Kuala Pahang, Pahang ... | 86.2 | 74.5 | 80.4 | 89 | 71 | 82 | 78 | 85.1 | 86.0 | 110.75 | 2813.1 | 7.68 | Dec. 24 | 185 | 149 | 2655.30 | 7.27 |
| Mount Faber, Singapore ... | 87.6 | 74.8 | 81.2 | 91 | 71 | 81 | 78 | 81.9 | 83.1 | 83.33 | 2167.4 | 3.90 | June 16 | 173 | 129 | 2397.65 | 6.57 |
| Bukit China, Malacca ... | 86.2 | 74.0 | 80.1 | 89 | 71 | 82 | 76 | 83.5 | 84.7 | 84.97 | 2158.0 | 4.05 | Ap'l. 13 | 178 | 139 | 2621.00 | 7.18 |
| Kluang, Johore ... | 88.0 | 71.6 | 79.8 | 93 | 69 | 80 | 74 | 81.6 | 82.2 | 79.35 | 2015.6 | 3.54 | May 3 | 186 | 156 | 2200.80 | 6.03 |
| Bukit Lalang, Mersing, Johore | 86.9 | 72.7 | 79.8 | 90 | 70 | 81 | 75 | 81.3 | 81.6 | 91.71 | 2329.3 | 4.20 | Dec. 24 | ... | ... | 2512.35 | 6.88 |
| Alor Star, Kedah ... | 89.6 | 73.3 | 81.5 | 93 | 70 | 84 | 76 | 85.9 | 86.3 | 83.22 | 2113.9 | 4.64 | Aug. 31 | 166 | 149 | 2642.80 | 7.24 |
| Kota Bharu, Kelantan ... | 87.6 | 73.0 | 80.3 | 91 | 70 | 83 | 76 | 83.8 | 84.1 | 108.23 | 2749.3 | 6.25 | Dec. 31 | 181 | 149 | 2488.35 | 6.78 |
| Kuala Trengganu, Trengganu | 87.1 | 72.8 | 80.0 | 90 | 70 | 82 | 76 | 82.9 | 83.7 | 119.48 | 3034.9 | 10.61 | Nov. 18 | 185 | 141 | 2656.55 | 7.27 |
| HILL STATIONS. | | | | | | | | | | | | | | | | | |
| Fraser's Hill, Pahang 4268 ft. Pahang. ... | 73.1 | 62.0 | 67.6 | 77 | 60 | 68 | 64 | 71.1 | 71.5 | 93.90 | 2385.2 | 2.42 | Sept. 6 | 235 | 198 | 1907.15 | 5.23 |
| Cameron's Highlands, Tanah Rata, Pahang 4750 ft. ... | 72.4 | 55.7 | 64.1 | 75 | 49 | 68 | 61 | 69.5 | 69.4 | 94.78 | 2407.2 | 2.84 | Sept. 7 Oct. 6 | 237 | 203 | 1783.65 | 4.89 |
| Cameron's Highlands, Rhodendron Hill, Pahang 5120 ft. ... | 71.9 | 59.5 | 65.7 | 77 | 57 | 66 | 61 | ... | ... | 98.45 | 2500.8 | 3.72 | Sept. 7 | 237 | 201 | 1850.55 | 5.07 |

Compiled from Monthly Returns supplied by the Meteorological Branch, Malaya.